



EYEWITNESSES

Activity

BUG

HUNTER

CONTAINS MORE THAN
50
STICKERS

Explore nature with loads of fun activities

EYEWITNESS

Activity

BUG HUNTER

by David Burnie





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A WORLD OF IDEAS:
SEE ALL THERE IS TO KNOW



Contents

4	The world of bugs	40	Fun with flies
6	Essential equipment	42	Soaking up the Sun
8	Bug habitats	44	Freshwater insects
10	Hide and seek	46	Spiders
12	Tricks and traps	48	Web watch
14	Insects in the air	50	Good vibrations
16	After dark	52	Hanging by a thread
18	Butterfly bar	54	Spiders without webs
20	Raising caterpillars	56	Family life
22	Making a moth trap	58	Life in leaf litter
24	Feeding at flowers	60	Decisions, decisions
26	Training honeybees	62	Earthworms
28	Bee homes	64	Building a wormery
30	Insect architects	66	Helping bugs
32	On the trail	68	Bug classification
34	Friends and enemies	70	Glossary
36	Growing a home	72	Index
38	Mines and galleries		

BE SAFE! IMPORTANT NOTE TO PARENTS

Some of the activities in this book require adult supervision. Symbols are used to indicate where an activity must only be done with the help of an adult. An "Important" box gives further information about any risks involved and appropriate safety precautions to take. Please carefully check which activities require adult supervision and supervise your child where indicated.



Activities shown with this symbol must only be done with the help of an adult.



Take extra care when doing this activity.

Always ensure that your child follows instructions carefully. The author and the publisher cannot take responsibility for any accident or injury that occurs because the reader has not followed the instructions properly and will not be responsible for any loss or damage allegedly arising from any of the activities in this book.

IMPORTANT

Provides safety information and indicates whether an activity can be messy. Follow the guidance notes on those activities which are messy and should be carried out only in suitable places.

CHILDREN - BE SAFE!

READ THIS BEFORE STARTING ANY ACTIVITIES!

1 Tell an adult before you do any of the activities in this book as you will need an adult to supervise these activities.

2 Pay attention to the following symbols:



You need an adult to help you with an activity.



Take extra care with an activity.

3 Read the "Important" boxes - these provide safety information and let you know which activities may be messy and should only be carried out in suitable places.

4 Follow the instructions carefully.

REMEMBER!

Show respect to wild creatures and make sure you don't disturb animals' environments.

The world of bugs

Whether you live in the countryside or in a city, bugs are never far away. Most of them live outdoors, although, given the chance, quite a few will flutter, hop, or scuttle into people's homes. But what exactly is a bug? Why are they such successful animals? And what is the difference between bugs and other creepy crawlies? To find out the answers to all these questions, the place to start is right here!

The legs and wings are attached to the insect's middle part, or thorax

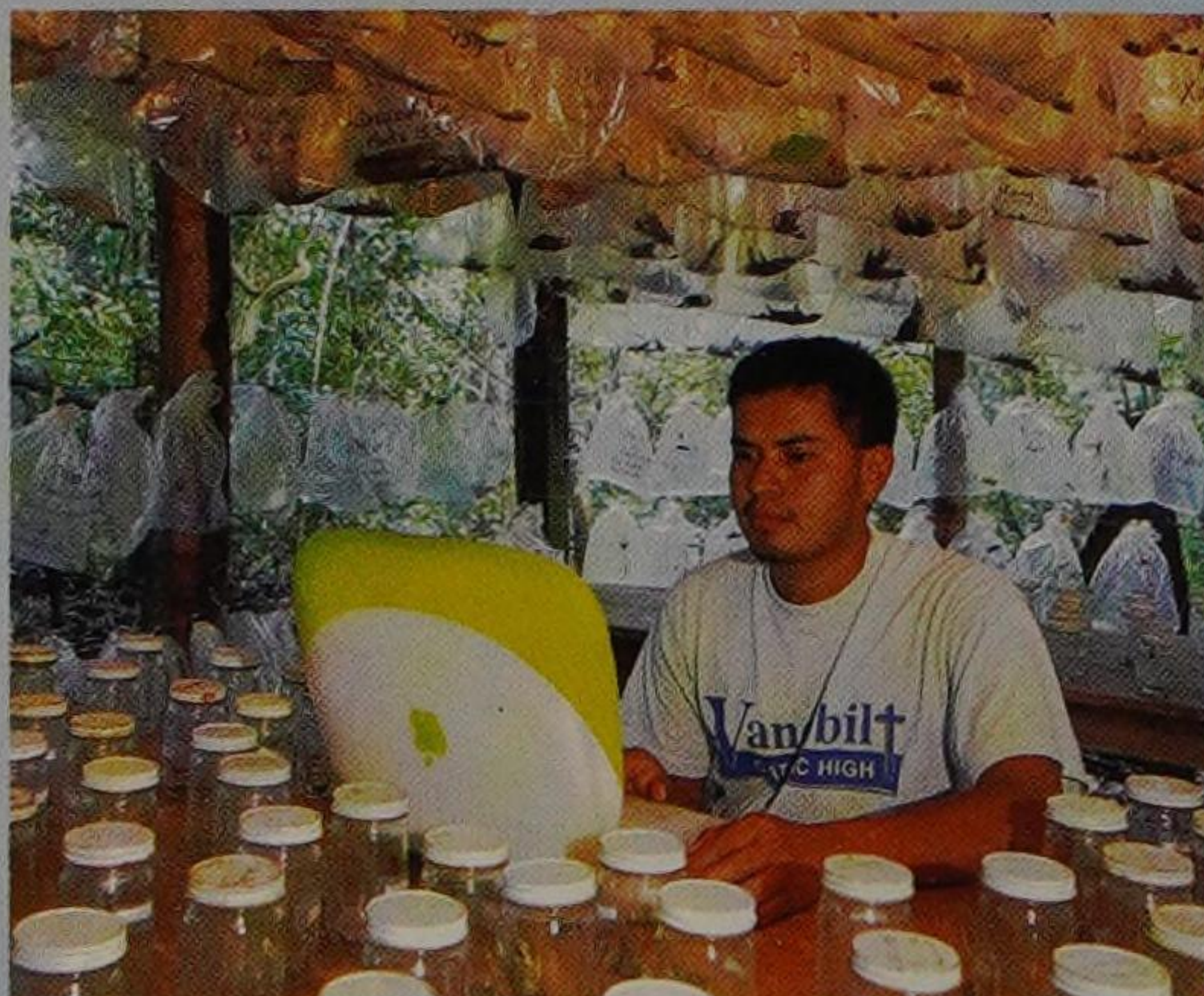
An insect's body is covered by a hard skeleton, which works like a case

Bug basics

Real bugs are always insects. There are more than a million different kinds of insects, which makes them the most numerous animals on Earth. Unlike other creepy crawlies, insects' bodies are divided into three parts – head, thorax, and abdomen. They have six legs, and most insects have wings. For insects, being able to fly is a huge plus. It is one of the reasons they are so widespread.

STUDYING INSECTS

Scientists who study insects are called entomologists. They work all over the world, identifying new species and investigating the way insects live. Some entomologists study farmland insects, particularly those that pollinate plants or feed on crops. Medical entomologists study insects that spread diseases as they feed.



◀ Bug research

This entomologist is investigating insects from the tropical forests of Costa Rica. Every year, entomologists identify thousands of new insects from all over the world, but lots more are still waiting to be discovered.

Identity parade

Lots of animals look like insects, but are built in different ways. Crustaceans have lots of legs, spiders always have eight, and centipedes and millipedes can have hundreds. Of all these animals, insects are the only ones with wings.



Crustacean



Spider



Centipede



Millipede



Insect

Insects have a pair of antennae, or feelers, on their heads

This beetle's abdomen is covered by its wings

This ladybird is in proportion to the huge beetle above

Ladybird

Lice use their claws to cling on to hairs



Eeeeeek!

Why is it that bugs give so many people the creeps? Sometimes it is because they can bite or sting, and sometimes it is to do with the unpredictable way they move. Some bugs scuttle about in a jerky way, while others land on our clothes or skin. Some even live aboard people – this louse is clinging to a human hair.

Essential equipment

Because insects are small, you need to get close to see how they work. One way to do this is to collect them – see below to find out what to pack in your collecting kit. To get a good look at most bugs, you will need a magnifying glass or hand lens. A magnifying glass enlarges by about two or three times, which is enough to see lots of extra detail. A hand lens is even better because it magnifies by about ten times, but is small enough to fit in a pocket.

BUG HUNTER'S CODE

When you go bug hunting, it is important that you do not harm any bugs or yourself. Stick to these three rules:

- Don't touch any bug with your bare hands unless you know that it is harmless.
- If you collect a bug to study it, release it when you have finished.
- If you go bug hunting at night, make sure you have an adult with you.

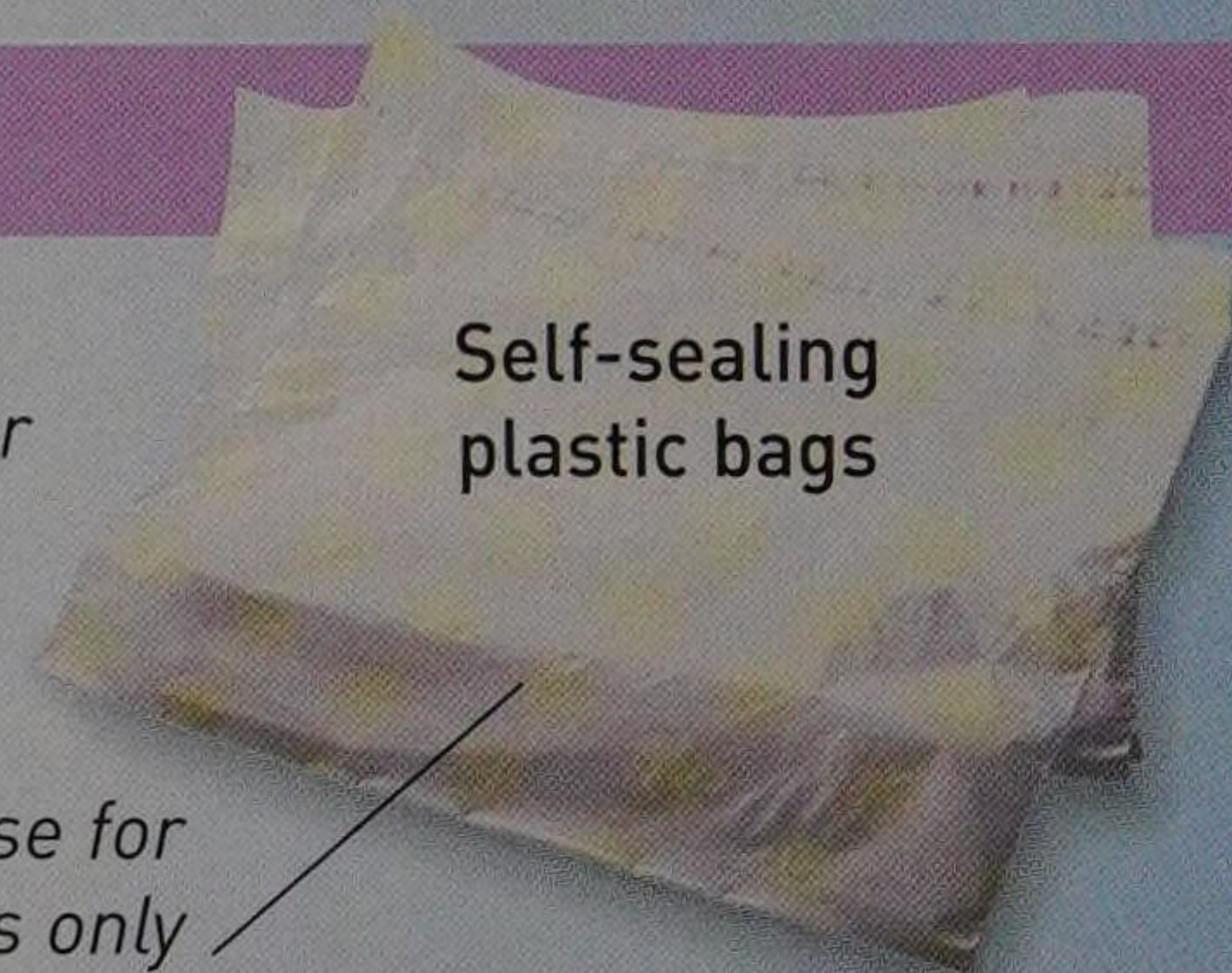
COLLECTING KIT

The most important part of a bug-collecting kit is a set of containers for living animals. Jam jars are good, if you make air holes in their lids. You can also use empty margarine tubs, as long as you give them a thorough wash and rinse. Use a drawing pin to make air holes in the lid, put in some kitchen roll as padding, and your bug box is ready.



Jam jar

Use this for live bugs



Self-sealing plastic bags

Use these for dead bugs only



Magnifying glass

Keep lens clean



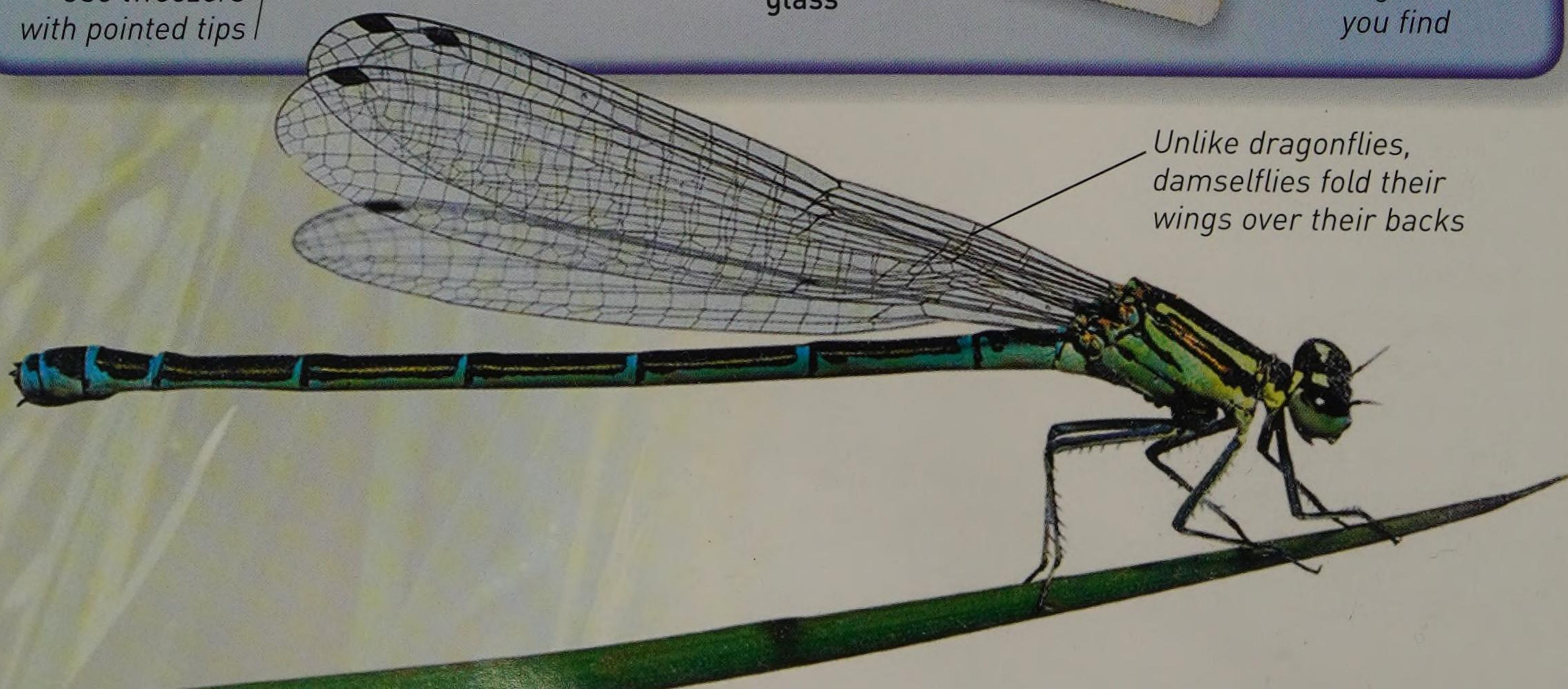
Tweezers

Use tweezers with pointed tips



Notebook, pencils, coloured crayons

Sketch the bugs that you find



Unlike dragonflies, damselflies fold their wings over their backs

IDENTIFYING BUGS

When looking at bugs, run through the list of features below, and then check the field-guide flaps. You'll soon be able to tell one type of insect from another.

- Long, slender body and four wings that stick out sideways: dragonfly
- Long, slender body and four wings that fold back: damselfly
- Long body and extra-large back legs, with, or sometimes without, wings: cricket or grasshopper
- Broad body and mouthparts that pierce and suck: plant bug

- Hardened forewings that fit over abdomen like a case: beetle
- Two-winged flying insect: true fly
- Big, colourful wings held above body at rest: butterfly
- Narrow waist, slender wings, and bright stripes: bee or wasp



Beetle

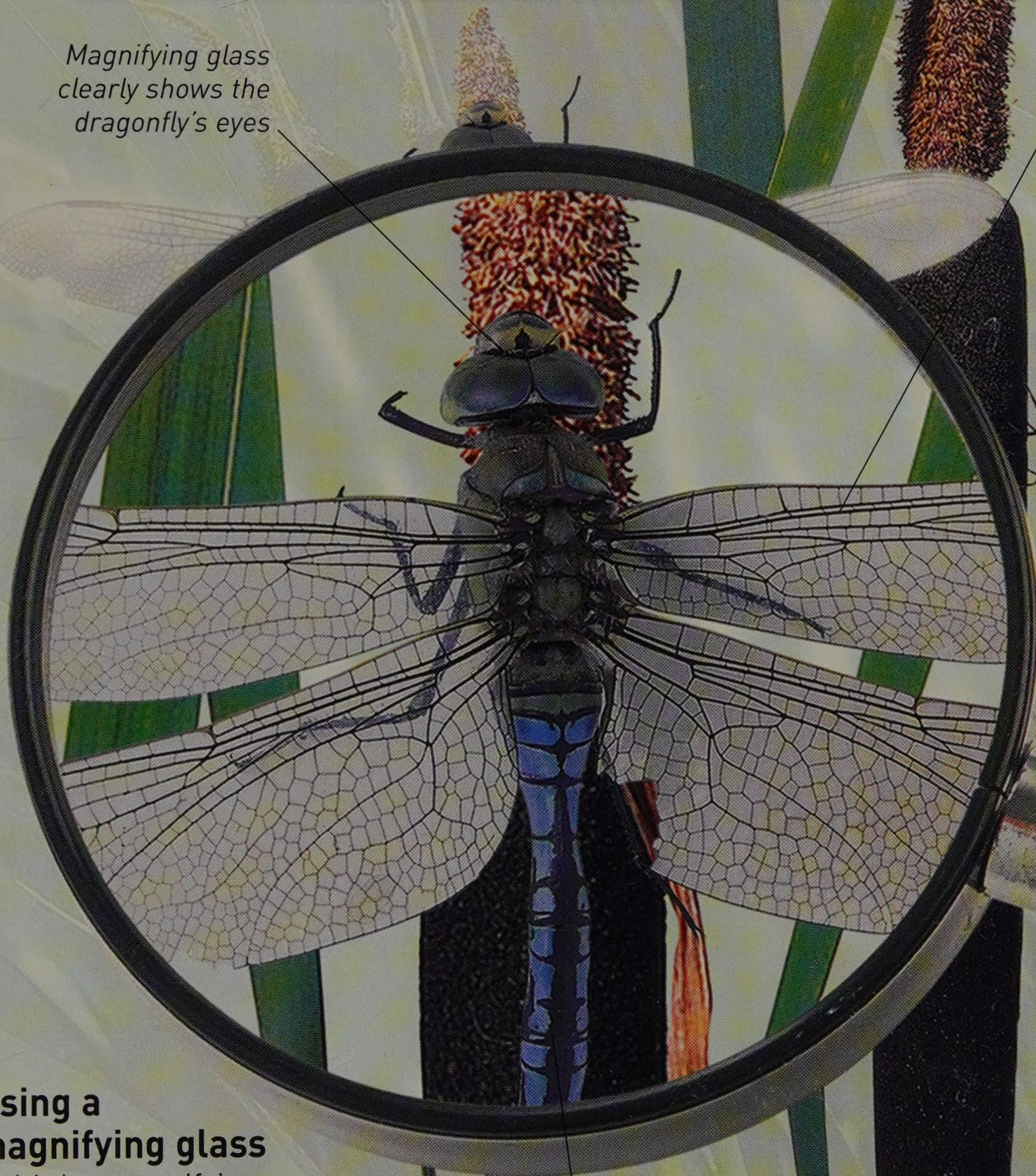
Hardened forewings

Soft brush for nudging bugs



Magnifying glass clearly shows the dragonfly's eyes

Wing veins vary between different types of dragonfly



Using a magnifying glass

Hold the magnifying glass close to the insect, then gradually pull it away until the insect is in focus. Use a soft cloth to keep the lens clean.

A dragonfly's colour helps to identify it

Bug habitats

When you start bug-watching, you'll soon notice that different bugs live in different places. For example, bees and butterflies stay close to flowers, while dragonflies prefer ponds and streams. Woodlice live in leaf litter – a layer of dead leaves under shrubs and trees. These different places are called habitats. A habitat is more than just a home. It gives a bug everything it needs to survive, including food and the right conditions for breeding.

Freshwater ►

Lots of bugs live in freshwater, so ponds are good places for bug-watching. Some insects live on the surface, while others swim below it. Dragonflies speed through the air, catching other insects on the wing. If you have a dip net, you'll find that swimming bugs are easy to catch. Be careful not to touch them because some of them can bite!



◀ Leaf litter

One of the best places to hunt bugs is in leaf litter – the crumbly compost that forms when dead leaves rot down. Leaf litter is home to many kinds of insects, and other creepy-crawlies as well. Many leaf litter animals, such as this woodlouse, like surroundings that are dark and damp.



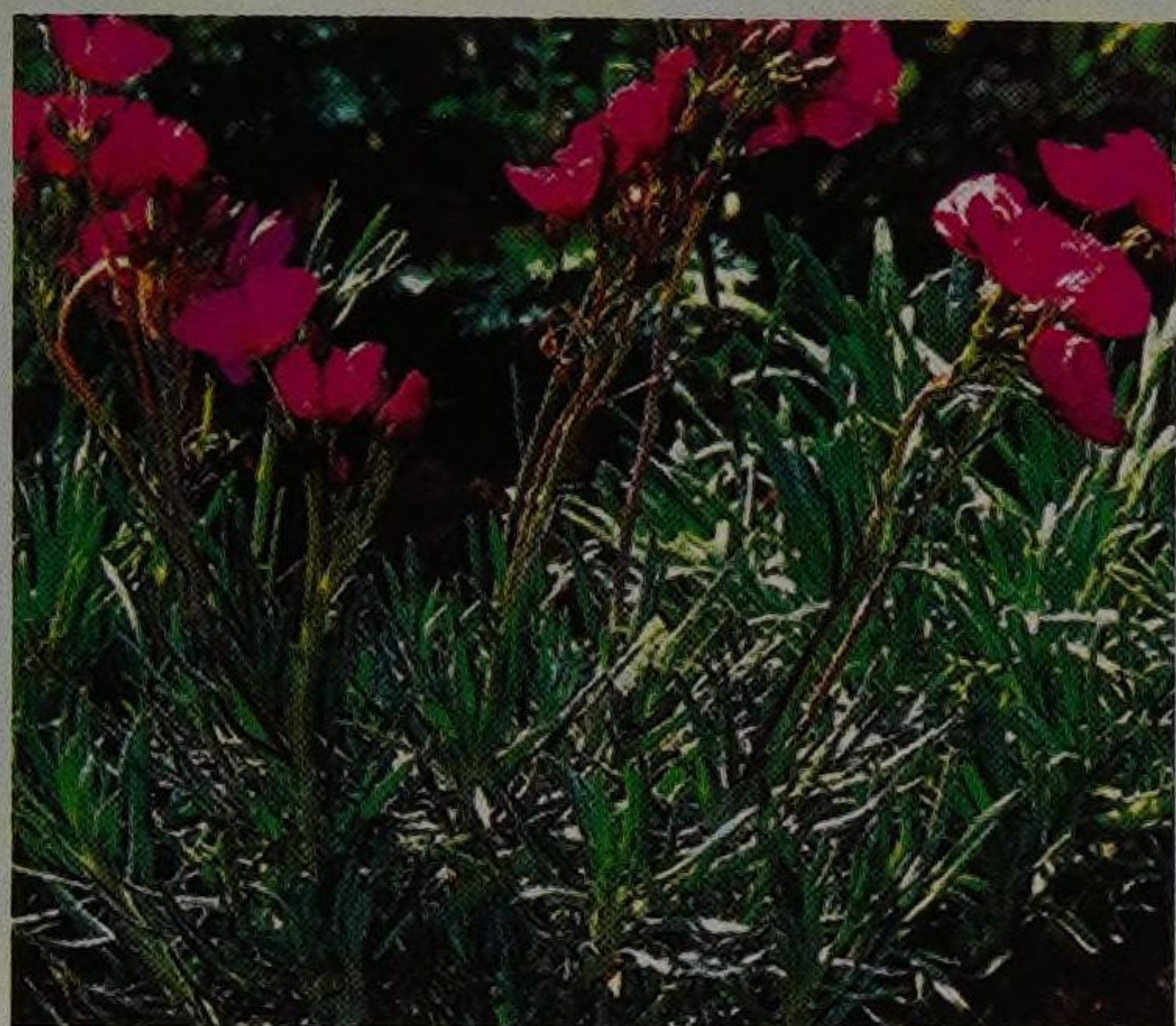
IMPORTANT

Take care when lifting up branches or stones because animals beneath them can sometimes bite or sting. It's best to lift stones with a stick.

▲ Trees and shrubs

Many insects live in trees and shrubs because there is plenty for them to eat. Caterpillars and crickets feed on leaves, while aphids suck up sap. Many of these insects are well camouflaged because they need to hide away from birds.

Leaves are ideal places for bugs to hide

**◀ Grass and flowers**

Flowery places are perfect for spotting butterflies, bees, and hoverflies. These insects visit flowers to feed on nectar – a sugary liquid food. Sunny days are best because nectar-feeders like to be warm as they work.

**▲ Walls and paving**

In warm weather, walls and paving are good places to spot mini-animals on the move. Wall wildlife includes tiny red velvet mites, and jumping spiders, which leap onto their prey.

Bugs indoors

You don't have to go outside to see bugs, because some kinds live indoors. Indoor bugs include temporary visitors, such as flies and mosquitoes, and long-term residents, such as spiders. Spiders are useful animals to have indoors, because they keep insects under control.

Kitchens

In summer, houseflies and bluebottles often fly into kitchens through open doors and windows. They come indoors to look for food or for somewhere to lay their eggs.



Flies often leave sticky spots where they land

Attics, cellars, and bathrooms

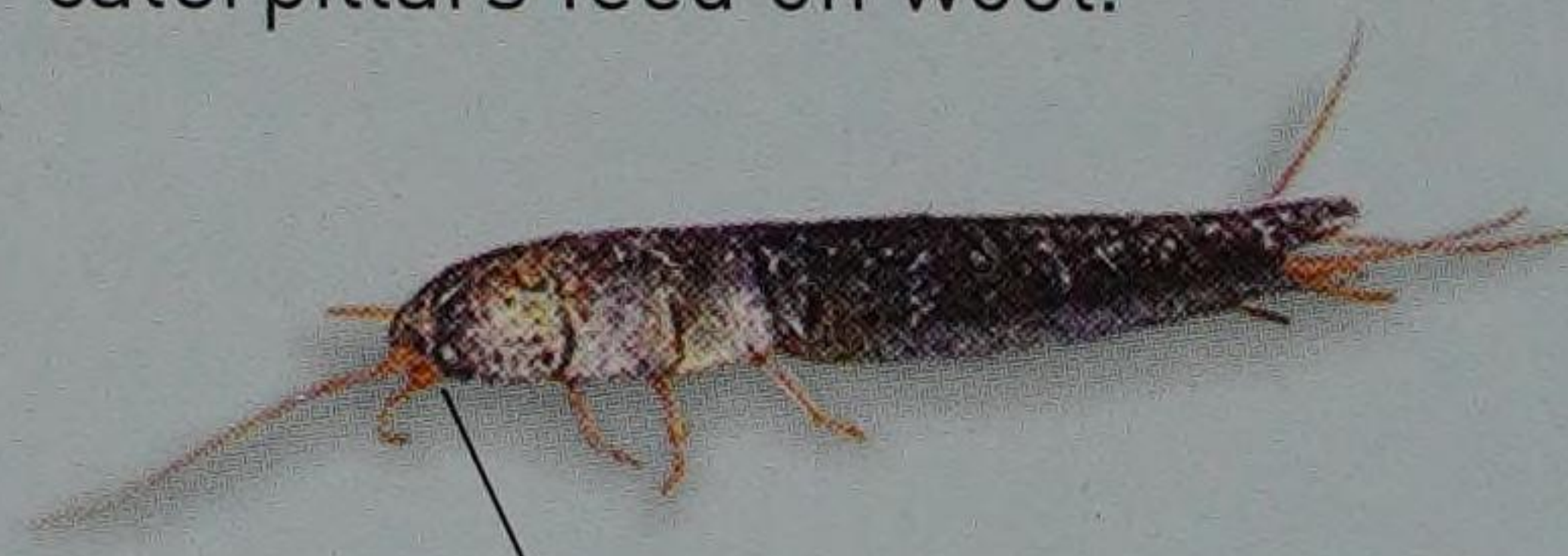
Spiders often lurk in quiet corners in attics and cellars, but some wander about after dark. House spiders sometimes get trapped in baths, because they cannot climb the slippery sides.



House spiders use their legs to feel their way

Drawers and cupboards

Silverfish live in cupboards, where they eat tiny specks of spilled food. Clothes moths sometimes live in drawers and wardrobes – their tiny caterpillars feed on wool.



Silverfish eat starchy and sweet food, including flour and sugar

WHERE TO LOOK

- Dragonflies and damselflies – ponds
- Woodlice, centipedes, and millipedes – leaf litter and under trees
- Moth caterpillars and sap-sucking bugs – trees and shrubs
- Butterflies, bees, and hoverflies – gardens and flowery grassland
- Beetles – on the ground and in leaf litter
- Spiders – grassy places and under stones

Hide and seek

Insects are all around us, but many are so well camouflaged that they are hard to spot. However, with the help of a tray and a piece of white paper, you can bring them out into the open. Most camouflaged insects live on plants, so shrubs and trees are good places to start. Tap a branch with a stick, and insects will tumble on to the tray. They will be easy to see on the white paper.

WHAT YOU WILL NEED

- Shallow tray
- White paper
- Scissors
- Stick
- Magnifying glass

Always ask an adult for help when using sharp scissors.



IMPORTANT

Don't pick up any of the bugs you collect because they may bite or sting. Let them crawl or fly back to where they came from.



- 1** Cut a piece of white paper to fit the bottom of your tray. Line the tray with the paper.



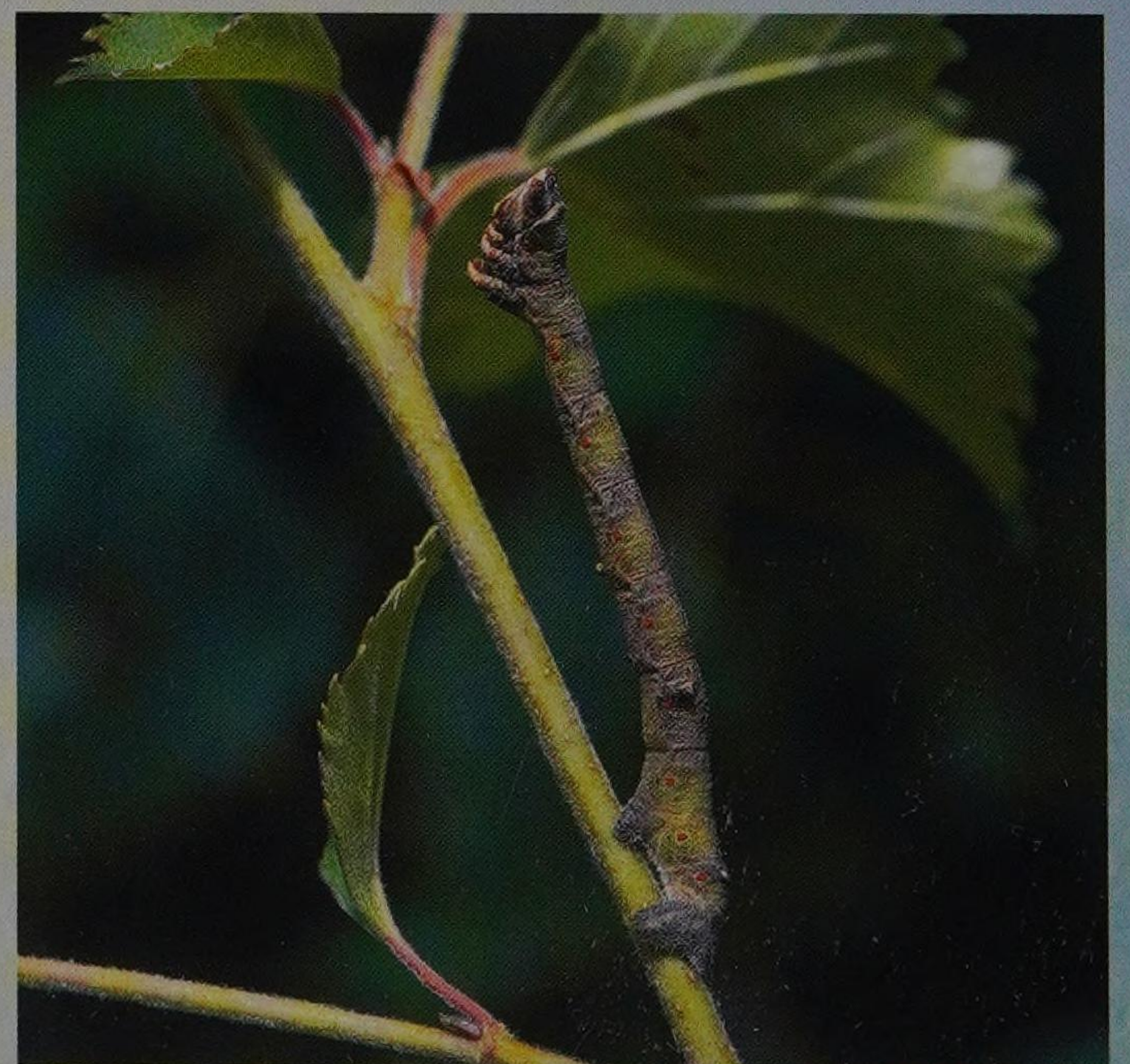
- 2** Place the tray under a leafy branch. Then gently tap the branch with a stick – or ask a friend to do it so you can see the insects tumble out.

INSECT CAMOUFLAGE

In the insect world, camouflage works in two ways. Many bugs use it to hide from their enemies, such as lizards and sharp-eyed birds. Predatory bugs are also camouflaged, so they can stalk or ambush their prey. Camouflage works best when a bug keeps perfectly still. Unlike humans, insects are very good at this. They can stay in the same position for hours without feeling uncomfortable or bored.

Living twig ►

This peppered moth caterpillar hides from its enemies by looking like a twig. Its skin is the same colour as bark. Its head is short and flat, making it look as if the top of the “twig” has snapped off.



GIFTED MIMICS

Insects aren't always quite what they seem. Some harmless kinds look like ones that sting, and they even move like them. These insect mimics fool many people, but if you know your bugs, you will be able to see through their disguise. Next time you see a bee or a wasp, look carefully to see if it is the real thing or a fake.

Wasp-mimicking flies ▼

Hoverflies often mimic wasps. Unlike real wasps, they have two wings instead of four, and they do not have a sting.

Hoverfly

Wasp

Shield bugs and their young rely on camouflage to survive

3

Use the magnifying glass to get a close-up view of the insects as they fly or crawl away. Try using the tray under different plants to see which bugs live where.

Tricks and traps

The world is a dangerous place for insects because they are a food source for a lot of other animals. Fortunately, insects have many ways of hiding and of fighting back. Wherever you are, it's easy to spot insects that survive, thanks to some clever tricks and traps. Some of the most common insect tricksters are click beetles and small sap-suckers called spittlebugs. Spittlebugs blow bubbles to make a sticky froth to hide in. If you see a frothy mass on a plant, wipe the foam away with a finger. You will find a soft-bodied bug inside.

Hiding in foam

Spittlebugs suck sap from grasses and other soft-stemmed plants. Adult spittlebugs can quickly hop away from danger, but young ones can only crawl. A shield of frothy bubbles helps to keep them out of harm's way. The best time to look for spittlebug froth is in spring and early summer.

WHERE TO LOOK

- Spittlebugs – on plants in gardens and grassy places
- Ant lions – on the ground in warm places with loose, sandy soil
- Click beetles – on plants in gardens, grassy places, and fields
- Bombardier beetles – on the ground among stones or fallen leaves

This young spittlebug has been revealed by wiping away its froth

Spittlebug froth is sometimes known as cuckoo spit, although it is not made by birds



Insect artillery

Ant lion grubs dig pits in sandy soil and then lurk inside them. If another insect walks by, the ant lion flicks sand at it to make it fall into the pit. If you find an ant lion pit, try tapping a blade of grass on the edge. The ant lion will flick sand at it, mistaking it for prey.

Ant lion grubs have camouflaged bodies and extra-large jaws for gripping their prey



Playing dead

If you find a click beetle, try putting it in the palm of your hand. At first, the beetle will pretend to be dead. A few seconds later, it will click a hinge behind its head, which throws it into the air. Click beetles use this trick to escape from their enemies.

When it pretends to be dead, a click beetle folds up its legs against its body

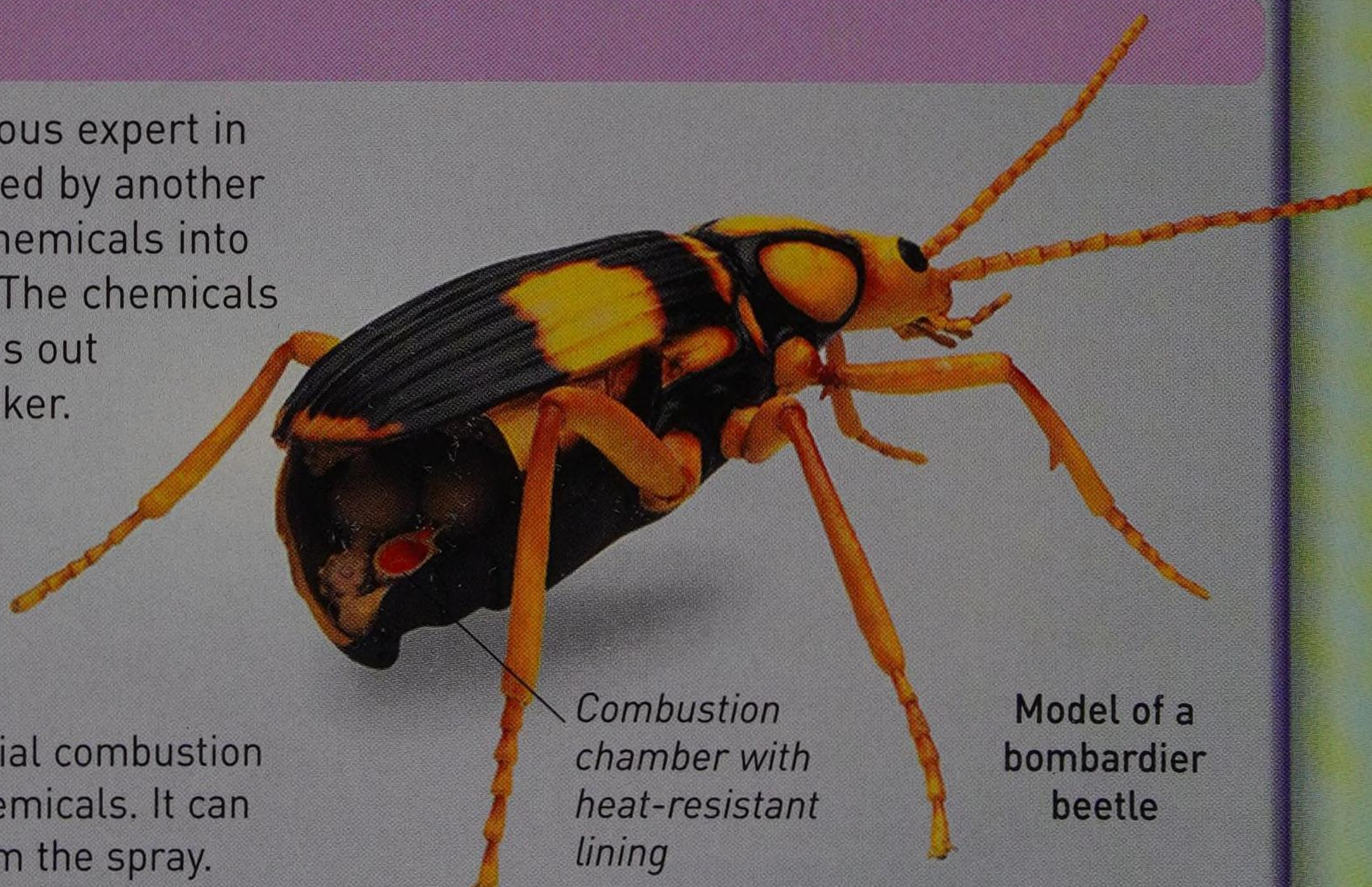


CHEMICAL WEAPONRY

The bombardier beetle is a famous expert in self-defence. If it feels threatened by another animal, it releases poisonous chemicals into a chamber inside its abdomen. The chemicals explode, spraying a jet of hot gas out of its body and towards its attacker. The beetle can produce up to 50 explosions in a row, giving it a chance to run away.

Explosive defence ►

The bombardier beetle has a special combustion chamber for mixing poisonous chemicals. It can swivel the tip of its abdomen to aim the spray.



Combustion chamber with heat-resistant lining

Model of a bombardier beetle

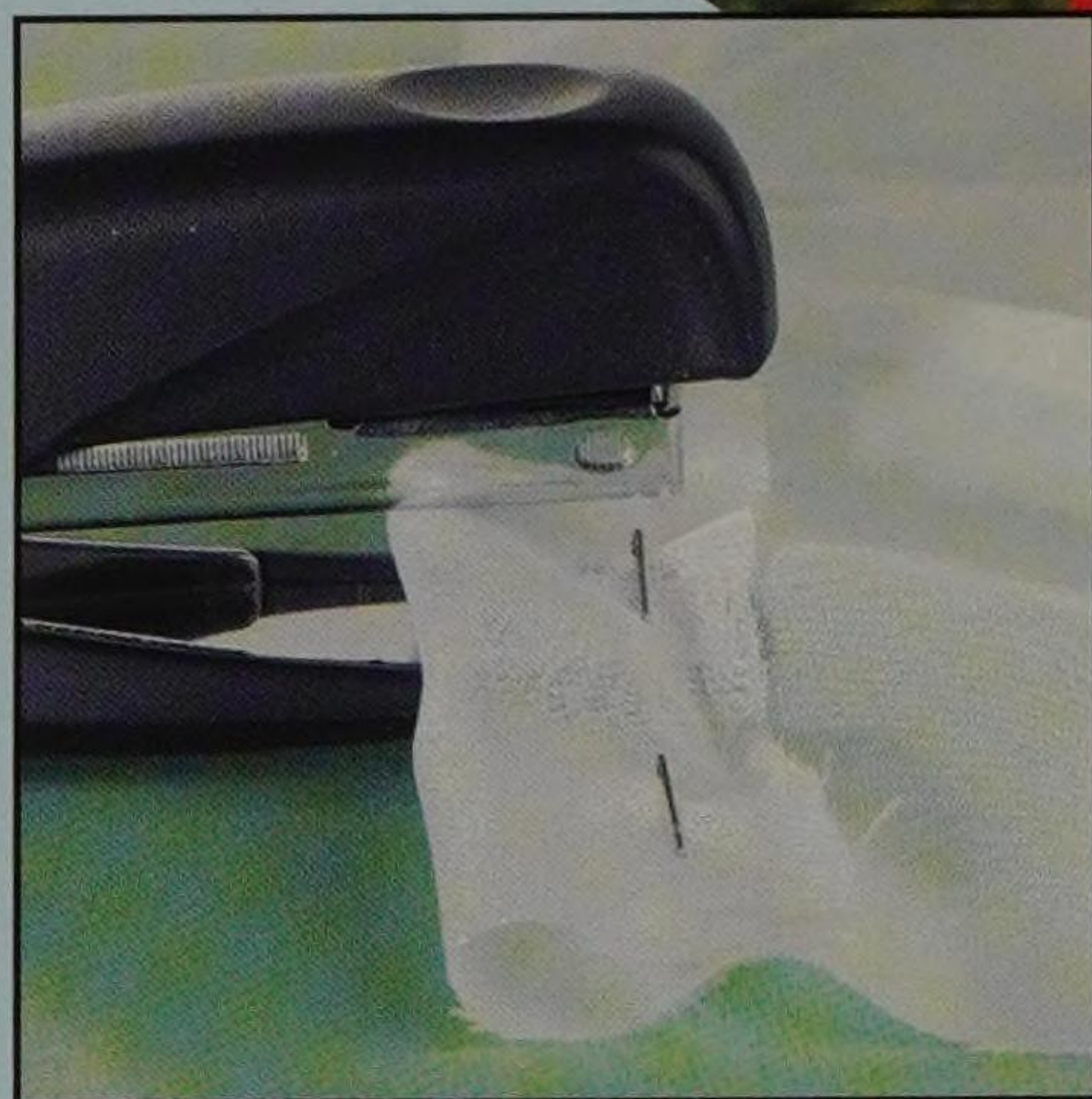
Insects in the air

In spring and summer, the air is often filled with flying insects. To get a close look at them, try making this butterfly net. Trawl your net just above flowers or tall grass, and you will be amazed how many flying insects you catch. To examine your haul, hold the handle out straight and let the net hang down. The insects inside will gradually crawl out and fly away.

WHAT YOU WILL NEED

- 80 cm (32 in) square of muslin
- Stapler and staples
- Wire coat hanger
- Pliers
- 60 cm (24 in) stick
- 10 cm (4 in) flexible wire
- Strong sticky tape

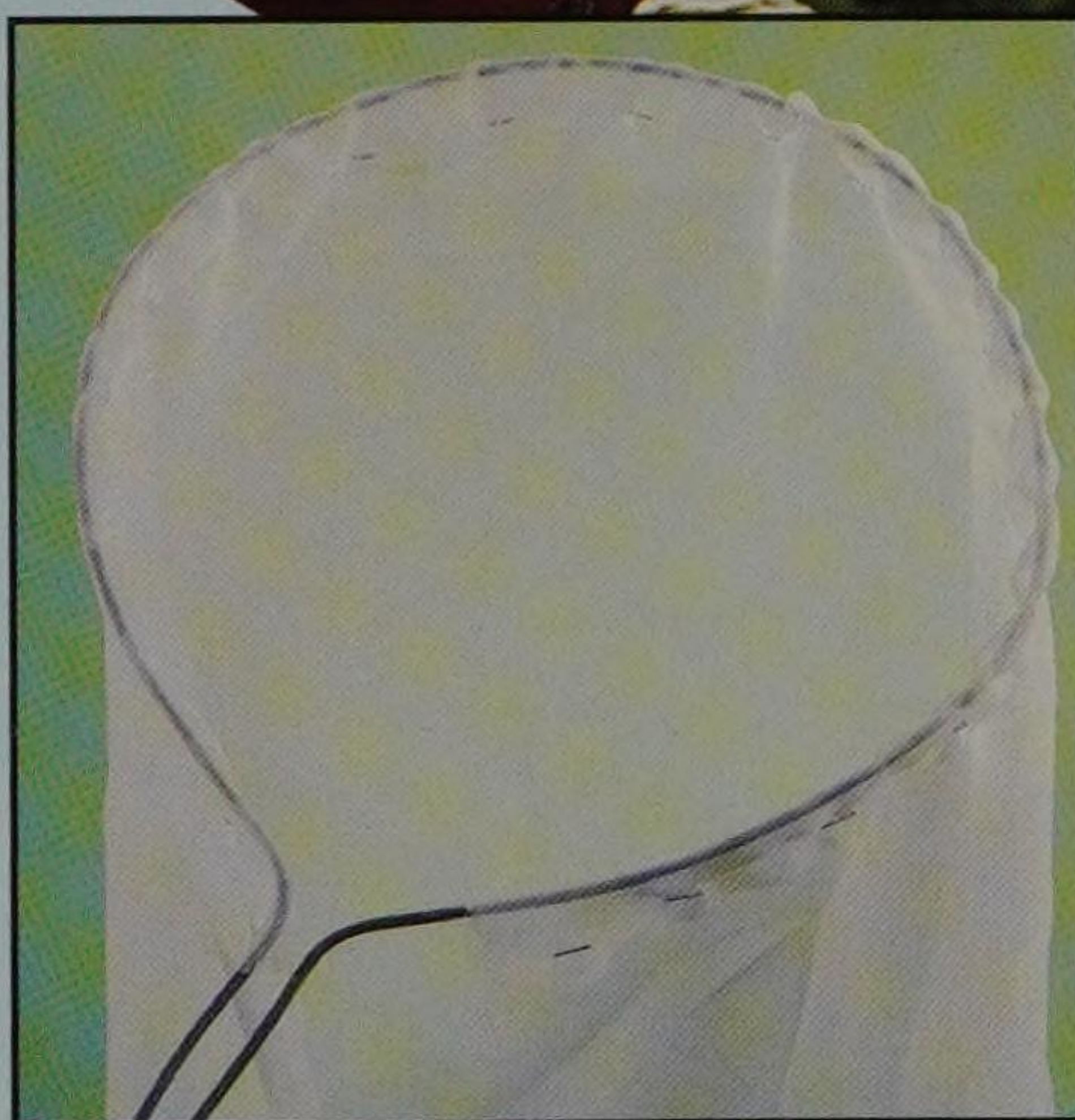
Ask an adult to help you with the coat hanger.



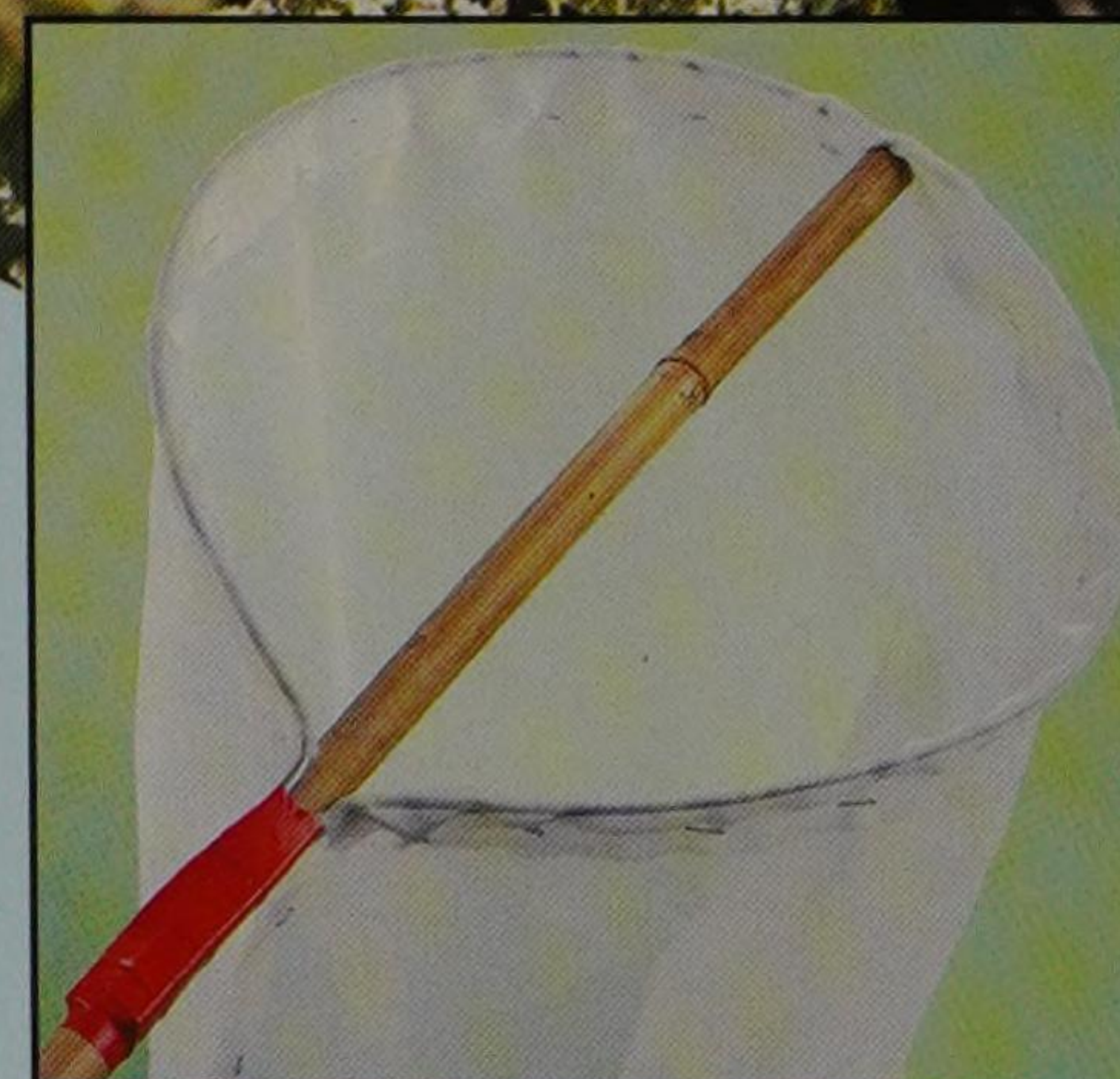
- 1** **Fold over** about 6 cm (2¼ in) along one edge of the cloth. Staple it down all the way along to make a hem.

HANDY TIP

Your net will be easier to swing to and fro if the handle is no more than 60 cm (24 in) long.



- 2** **Use the pliers** to straighten the hanger. Slide it through the hem, then grip the hanger by both ends, and carefully bend it to form a circle. Straighten the ends of the hanger so that they are ready to be taped to the stick.



- 3** **Put the stick** across the mouth of the net, and use the flexible wire to tie the stick to the far side. Then fasten the straight ends of the hanger to the stick using the tape.



INSECT WINGS

Compared to birds, insects have very varied wings. If you look carefully at a fly, you will see that it has just two wings, but most other insects have four. Sometimes, the front and back wings look the same, but often they are different. Beetles have extra-tough front wings, called elytra, which fit over their hindwings like a case. This case protects beetles' delicate hindwings from injury as they clamber around.



▲ Lacewing

A lacewing has four wings, and each one is criss-crossed by a network of veins. These strengthen the wings, and keep them in shape while they beat up and down.

TAKING OFF



▲ Up and away

A ladybird has to open its spotted forewings, then unpack its hindwings, which are folded underneath.

Flies can take off almost instantly, which is why they are so hard to swat. But for some insects – such as beetles – getting airborne takes a bit of preparation. Ladybirds need several seconds to get their wings ready, so instead of flying away they often prefer to walk. If you find a ladybird on a plant and nudge it with a blade of grass, you may see it open its wings and, after a moment, fly away.

4 Finally, use the stapler to stitch together the side and bottom of the net. Your net is now ready to use.

After dark

Lots of bugs are on the move after dark, when humans are asleep. Some bugs fly through the night air, but many more crawl and scuttle over the ground. By making a simple pitfall trap, it is easy to catch these nocturnal creepy crawlies. Then you can return to the trap during the day to examine your catch.

WHAT YOU WILL NEED

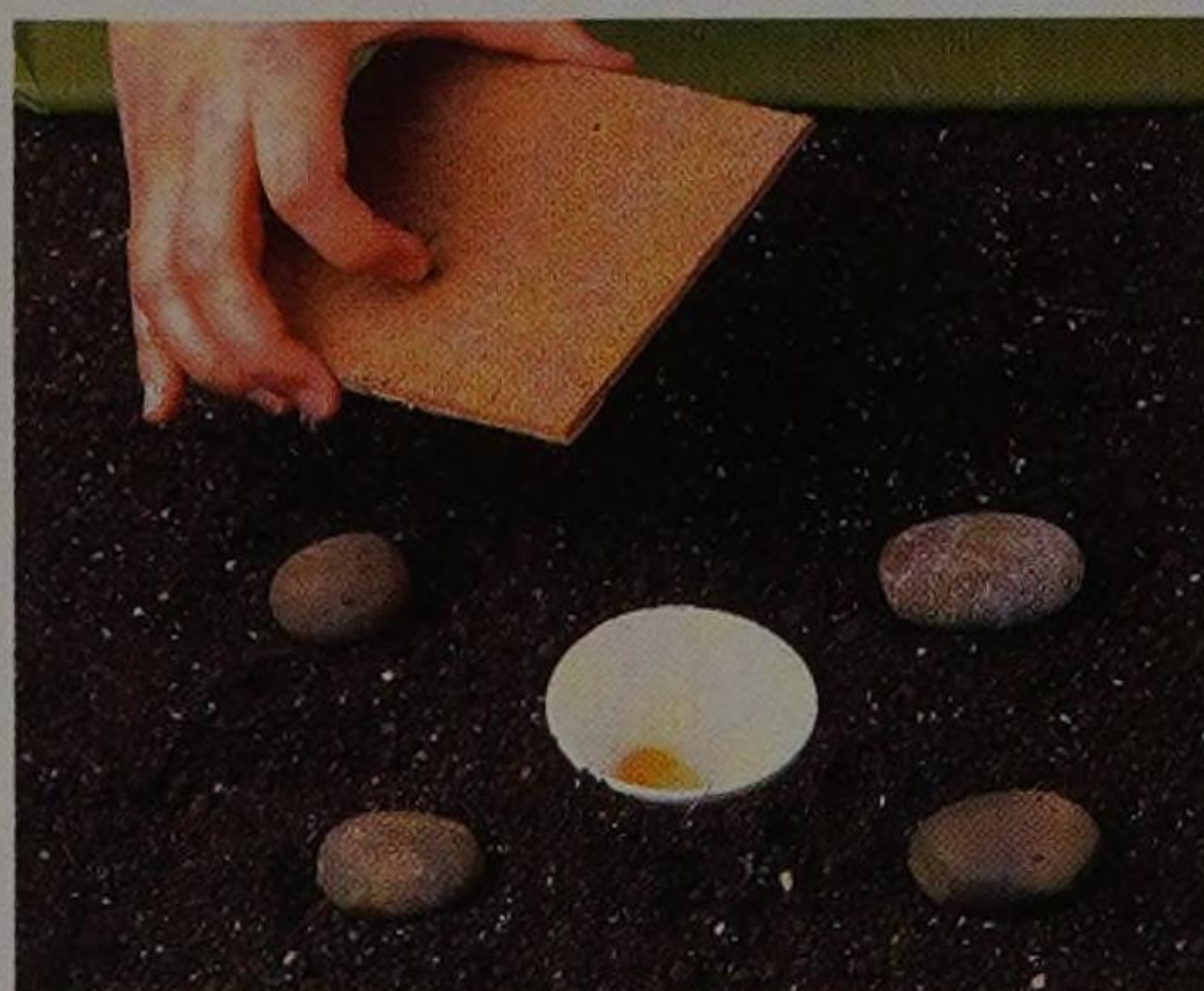
- Trowel
- Plastic cup or jam jar
- Food for baiting (cheese, fruit, or meat)
- Four small stones, corks, or marbles
- Tile or plywood about 10 cm (4 in) square
- Magnifying glass

IMPORTANT

Don't go outside after dark without an adult, and remember to release the insects you catch when you have finished studying them.



- 1 Dig a hole** in soft ground and bury the cup or jar exactly up to its rim. Place a piece of bait inside the cup or jar.



- 2 Put the stones** on the ground around the cup or jar, and place the tile over the top to make a rainproof roof.

- 3 Leave the trap** overnight and examine your catch in the morning. You can dig up the jar and take it indoors for a closer look. Vary the bait to see if it attracts different bugs.

BEETLES ON THE PROWL



Night patrol ▲

Ground beetles hunt caterpillars and other garden pests.

Many beetles are nocturnal hunters that feed on the ground. They are ideally built for this kind of life, with sturdy legs and hard forewings that fit over their back like a case to protect their delicate hindwings. Ground beetles are often black. This camouflages them in the darkness, providing some protection from predators.

LIGHTING UP



Unlike most nocturnal insects, fireflies and glow-worms are easy to find because they light up after dark. These insects make light inside their bodies and use it to attract a mate. Glow-worms light up on the ground, but fireflies light up on trees or bushes, or while they are on the wing. If you disturb one of these insects, its light will often dim or go out. But if you stay nearby and keep still, it will slowly come back on.

◀ **Glowing in the dark**

This female glow-worm is signalling to males flying overhead. Her light comes from special organs underneath her abdomen. Unlike the males, the female does not have wings and cannot fly.

Attracted by the smell of food, beetles and other animals fall into the trap and cannot climb back out



Butterfly bar

With their bright colours, butterflies are everyone's favourite insects. Like moths, they feed at flowers, sucking up sugary nectar with their tongues. To get a close look at butterflies feeding, make a butterfly bar. Instead of nectar, the bar serves a sticky mixture of sugar and over-ripe fruit – something that most butterflies cannot resist. After dark, try leaving the bar open to attract hungry moths.

WHAT YOU WILL NEED

- Over-ripe banana
- Mixing bowl
- Fork
- Saucepan
- Wooden spoon
- 100 g (3½ oz) unrefined dark brown sugar
- 250 ml (8¾ fl oz) water
- Paper plate
- Pencil
- String

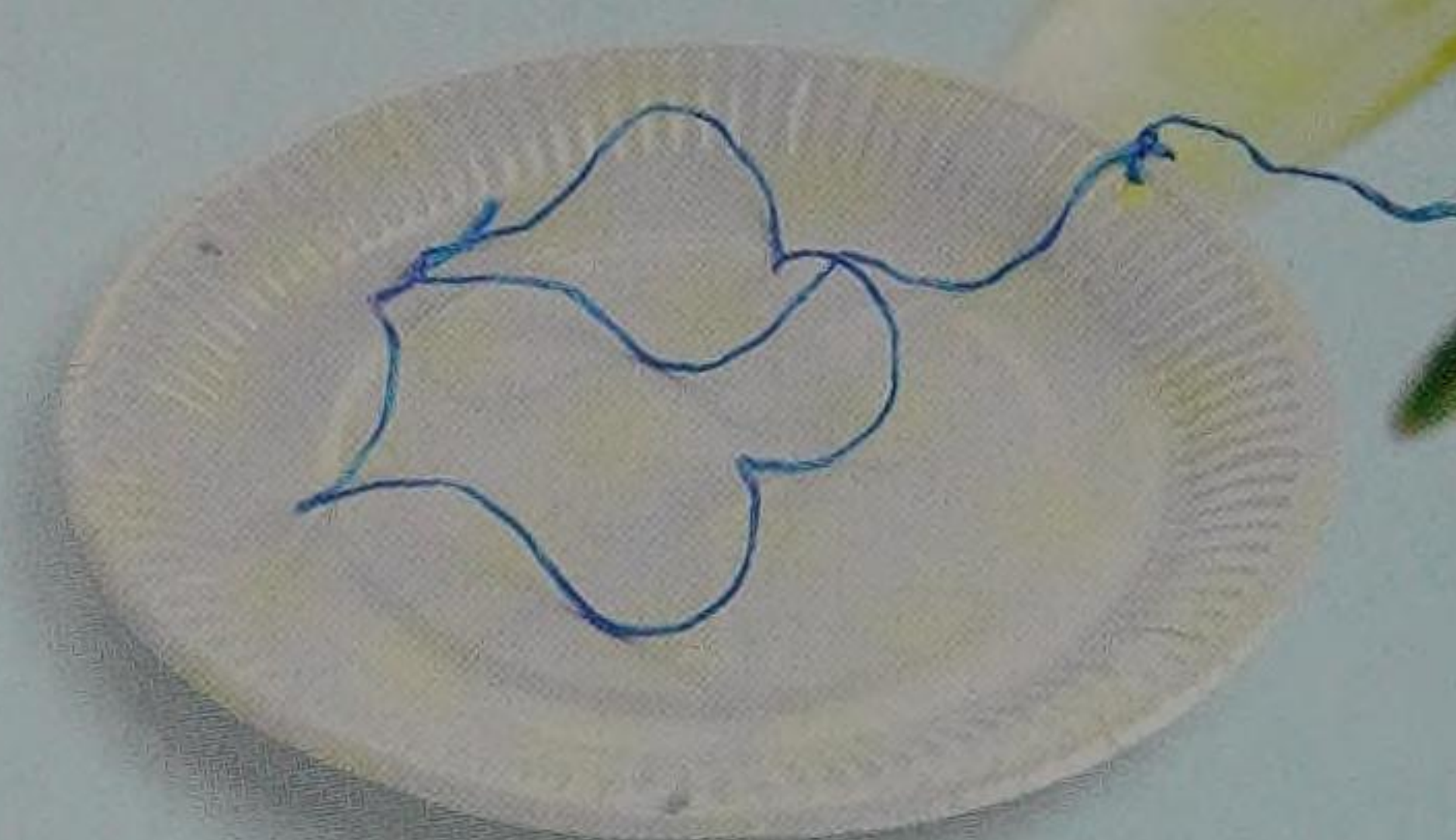


Ask an adult to help with cooking.



1 Peel the banana, slice it, and put the slices in the bowl. Use the fork to mash it into a paste.

2 Mix the banana paste, sugar, and water in the saucepan. Heat the mixture until it simmers, then leave it cooking until it becomes sticky. Turn off the heat and let it cool.



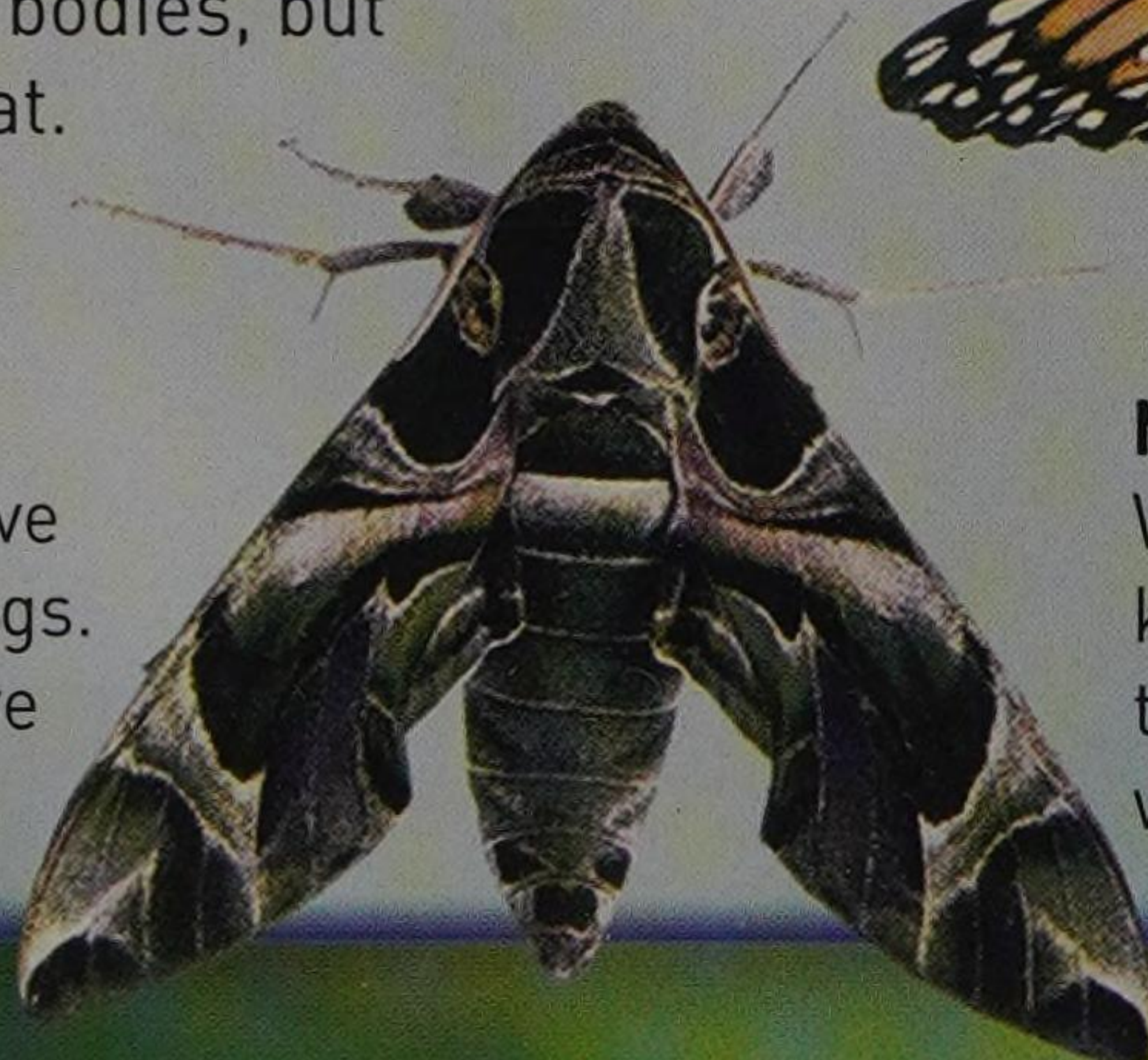
3 Make three holes in the plate with the pencil. Tie a piece of string around the plate through each hole.

BUTTERFLY OR MOTH?

Most butterflies are brightly coloured, and all of them fly during the day. Moths are often brown or grey, and most of them fly at night. But not all moths follow these rules. Some fly in broad daylight and look as colourful as butterflies. The best way to tell the difference is to look at their wings when they land. Butterflies usually hold theirs upright over their bodies, but most moths lay theirs flat.

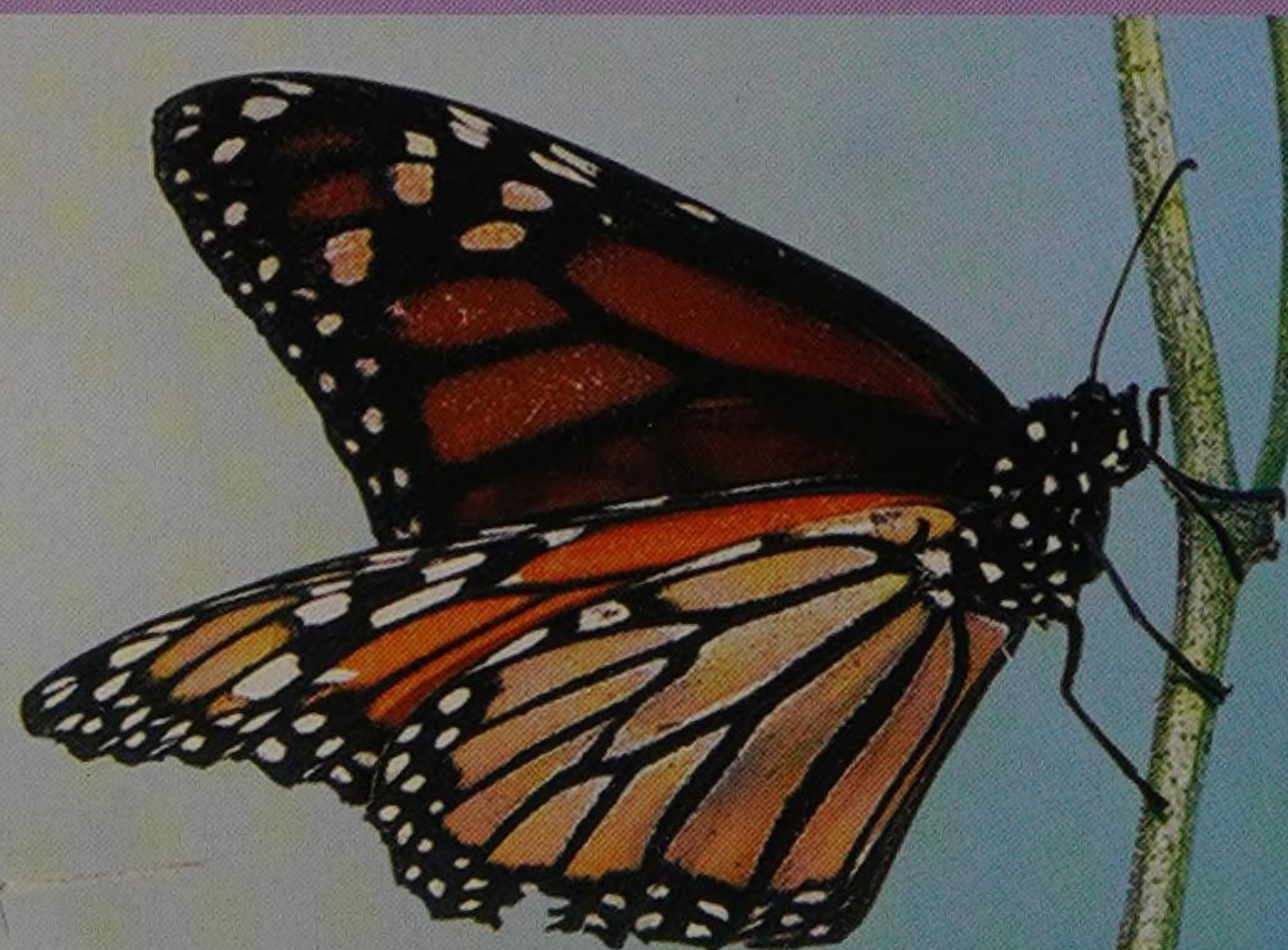
Oleander hawkmoth ►

Fast-flying hawkmoths have fat bodies and pointed wings. Like most moths, they have thick feelers, or antennae.



Monarch butterfly ▲

When it lands, a monarch keeps its wings upright. It has thinner antennae than a moth, with a knob at the end.



ROLL-UP TONGUES

If you watch butterflies feeding, you will see that their tongues work like drinking straws. A butterfly tests the food with its tongue and then starts to feed. When it has finished feeding, it coils up its tongue beneath its head. This means the tongue is out of harm's way when the butterfly takes to the air.



▲ Getting ready

This butterfly is unrolling its tongue so that it can start to feed.

Butterflies can sense sweet food with their antennae and with their feet

The mixture should be slightly runny so butterflies can suck it up

4 Tie the plate to a low branch, then smear on the paste. Stand back and watch the butterflies arrive.



WHAT YOU WILL NEED

- 5 litre (1 gl) plastic bottle
- Scissors
- Piece of muslin
- Jam jar
- Water
- Foodplants
- Caterpillars
- Large, thick elastic band

Raising caterpillars

If you are a keen bugwatcher, it's hard to beat the excitement of seeing caterpillars turn into adult butterflies. It's not difficult to find caterpillars, but if you want to keep them, you need to make a suitable home for them. One of the best ways is

to use a large plastic bottle fitted with a fabric roof. This lets the caterpillars get the fresh air that they need.



- 1 Cut off** the sloping sides and top of the bottle. Cut out a square of muslin around the bottom of the bottle, about 5 cm (2 in) bigger all round.
- 2 Fill the jam jar** with water and stand the caterpillar foodplants in the water. Put the jar and plants in the bottle.
- 3 Carefully put** the caterpillars on the plants. Then put the muslin over the top of the bottle and use the elastic band to hold it in place.

SHEDDING SKIN

In order to grow, all bugs have to shed their outer skin every so often. Each time they do this, they leave the old, empty skin behind. Caterpillars usually drop their skins on the ground, but spiders often leave theirs hanging from their webs. People often mistake the empty skins for living spiders, but it's easy to find out which is which. Touch it gently with a pencil – a skin won't scuttle away!



A fresh start ▲

This spider has just finished shedding its skin. Its old skin is above it, held in place by strands of silk. Spiders shed their skins many times in their lives. Insects stop once they have become adult and do not grow any more.

Changing shape

All insects change shape as they grow up. Grasshoppers change gradually each time they shed their skins. Young grasshoppers look like their parents, but without wings. Butterflies and moths change in a different way. They start life as caterpillars and change totally during a resting stage called a pupa.



◀ Egg

Most insects hatch from eggs. Butterflies glue their eggs to the leaves of plants so the caterpillars have food.

Caterpillar ▶

A caterpillar's job is to eat. As the caterpillar feeds, it grows quickly and sheds its skin several times.

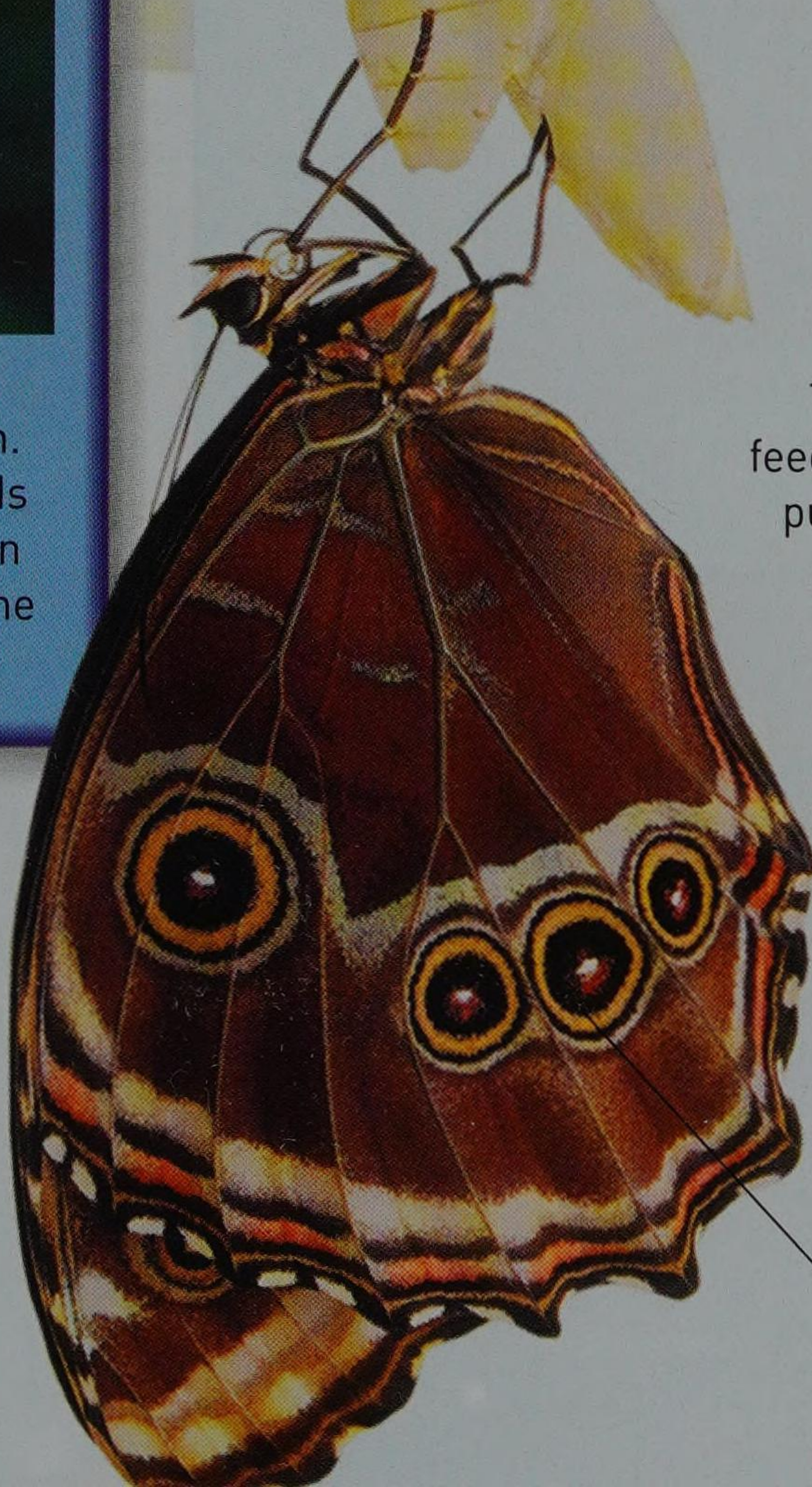


▲ Pupa

The caterpillar stops feeding and turns into a pupa. Inside the pupa, its body is rebuilt.

◀ Adult

Finally, the pupa splits and an adult butterfly crawls out. It waits for its wings to harden, then flies away.



Adult hangs from pupa while its wings harden

IMPORTANT

Caterpillars are fussy eaters, so give yours the same plants that you found them on. Remember to check the water level in the jam jar every day, so the leaves do not wilt.

WHAT YOU WILL NEED

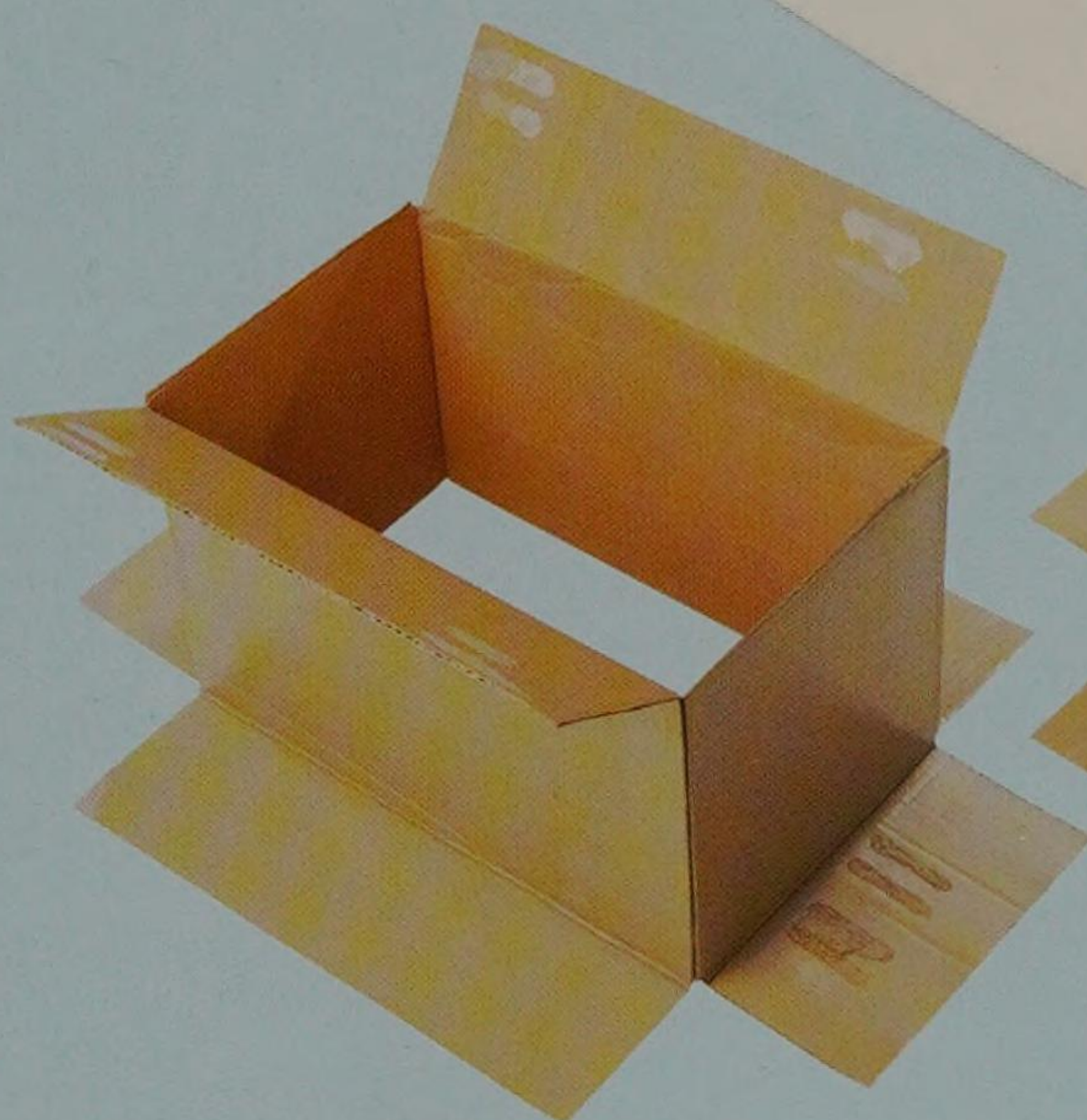
- Torch with flat base
- Oblong cardboard box (at least 25% higher than the torch)
- Egg boxes
- Stapler
- Glue stick
- Scissors

Ask an adult to help you cut the box because this can be difficult.

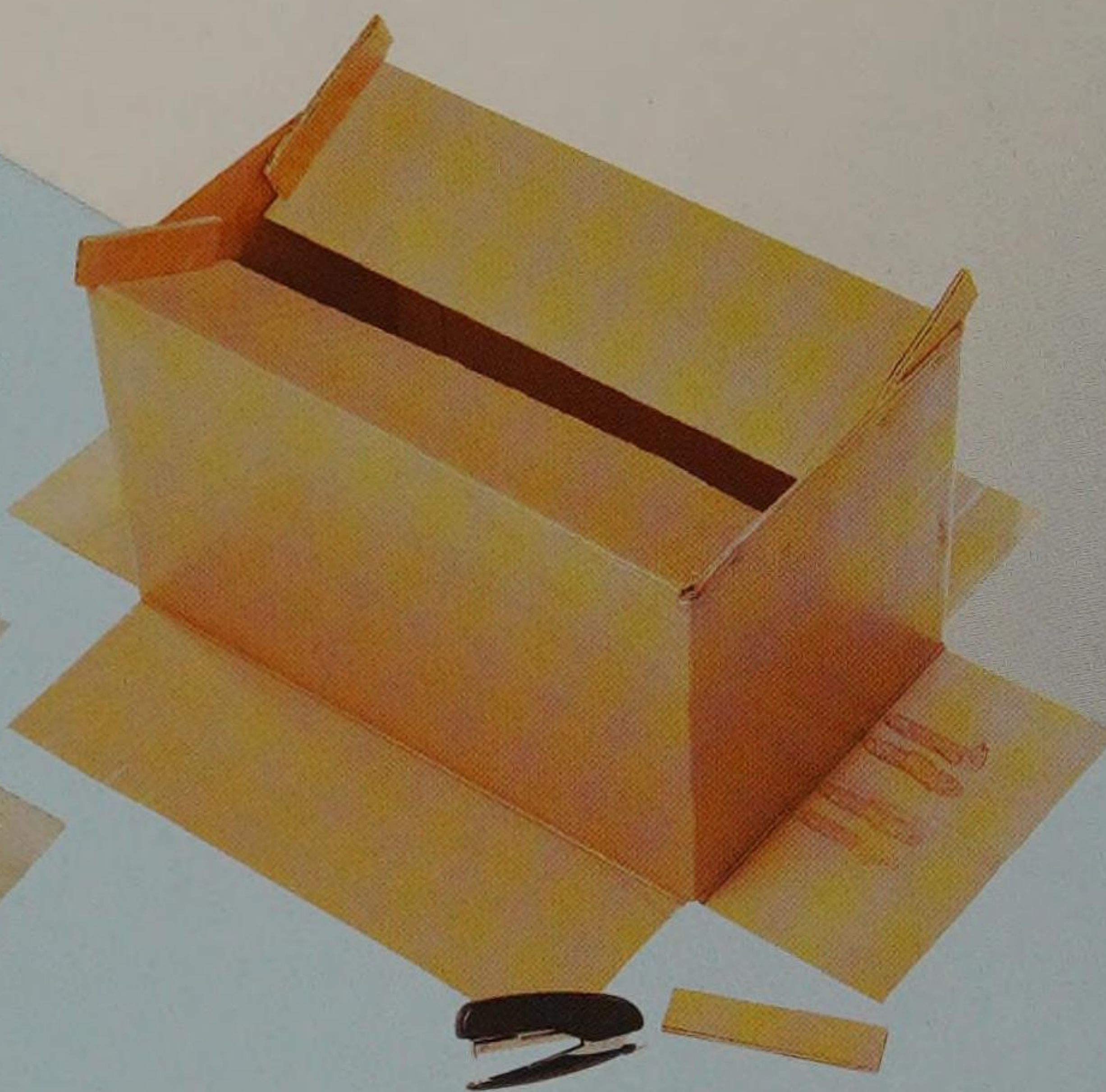


Making a moth trap

Moths cannot resist bright lights, which is why they often come to windows after dark. If you make a moth trap, you can collect moths overnight and examine them during the day. When you open up your trap, you'll be able to see the beautiful camouflaged patterns that many moths use to hide. Moths are completely harmless insects – they cannot sting or bite. Once you have admired them, let them fly away.



- 1** **Open all the flaps** of the box. Carefully cut off the top flaps on the shortest sides, leaving the two long ones. Keep the flaps you have cut off to use later.



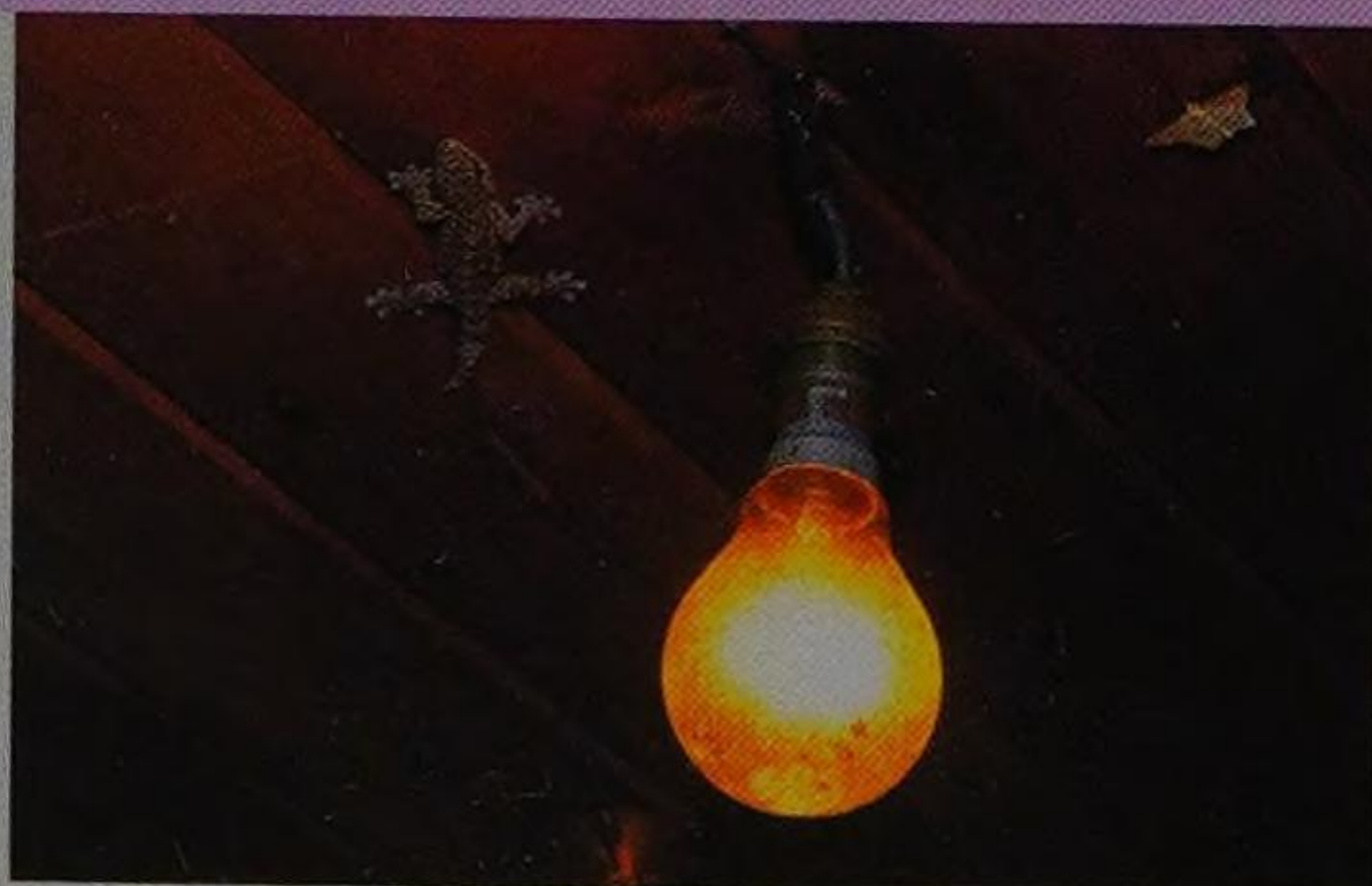
- 2** **Take one** of the flaps that you have cut off and cut it into four narrow strips. Staple these to the top of the box, as shown, so they make a valley with a narrow slit about 2 cm ($\frac{3}{4}$ in) wide.



- 3** **Put the box** on one end. Remove the tops from the egg boxes and glue the bottoms to the inside of the box at each end. Moths will rest on these once they have flown into the box.

LURED BY LIGHT

No one knows for certain why moths are attracted to light. One theory is that they fly off course, mistaking artificial light for moonlight. Lights attract lots of other insects as well, which means they create great places to go bug-watching.



Light meal ▲

This gecko is lurking near a light, where it will find moths to eat.

MOTHS INDOORS

On summer nights, moths often fly indoors but usually find their way back out. Some moths stay inside all their lives. Clothes moths lay their eggs on anything made of wool. Their caterpillars feed on the wool fibres and leave lots of tell-tale holes. Adult clothes moths are small, with dusty, golden wings. When in danger, they often scuttle into dark corners.



Well wrapped up ►

These are the caterpillars of the case-bearing clothes moth. Each caterpillar lives inside a portable case, which it makes from silk and short strands of chopped-up wool.

4

The trap is now ready. To use it, put it outside after dark.

Turn on the torch, stand it on end, and carefully place the trap over it. Leave the trap for 1–2 hours, then gradually lift up the box to look at the moths inside.

IMPORTANT

Always ask an adult to come with you to set up the trap after dark. Choose a dry night and put the trap well away from any other bright lights.

Feeding at flowers

People like flowers because they look pretty, but insects like them because they contain food. The food is nectar – a sugary liquid that is packed with energy. In return for the supply of nectar, insects spread pollen from flower to flower, helping plants make their seeds. Flowers are specially shaped to fit particular insect visitors. If you watch bees, butterflies, and hoverflies, you can see which kinds of flowers they visit and which ones they avoid.



Only bees can open a toadflax's petals to reach inside

Basket containing pollen that the bee has collected

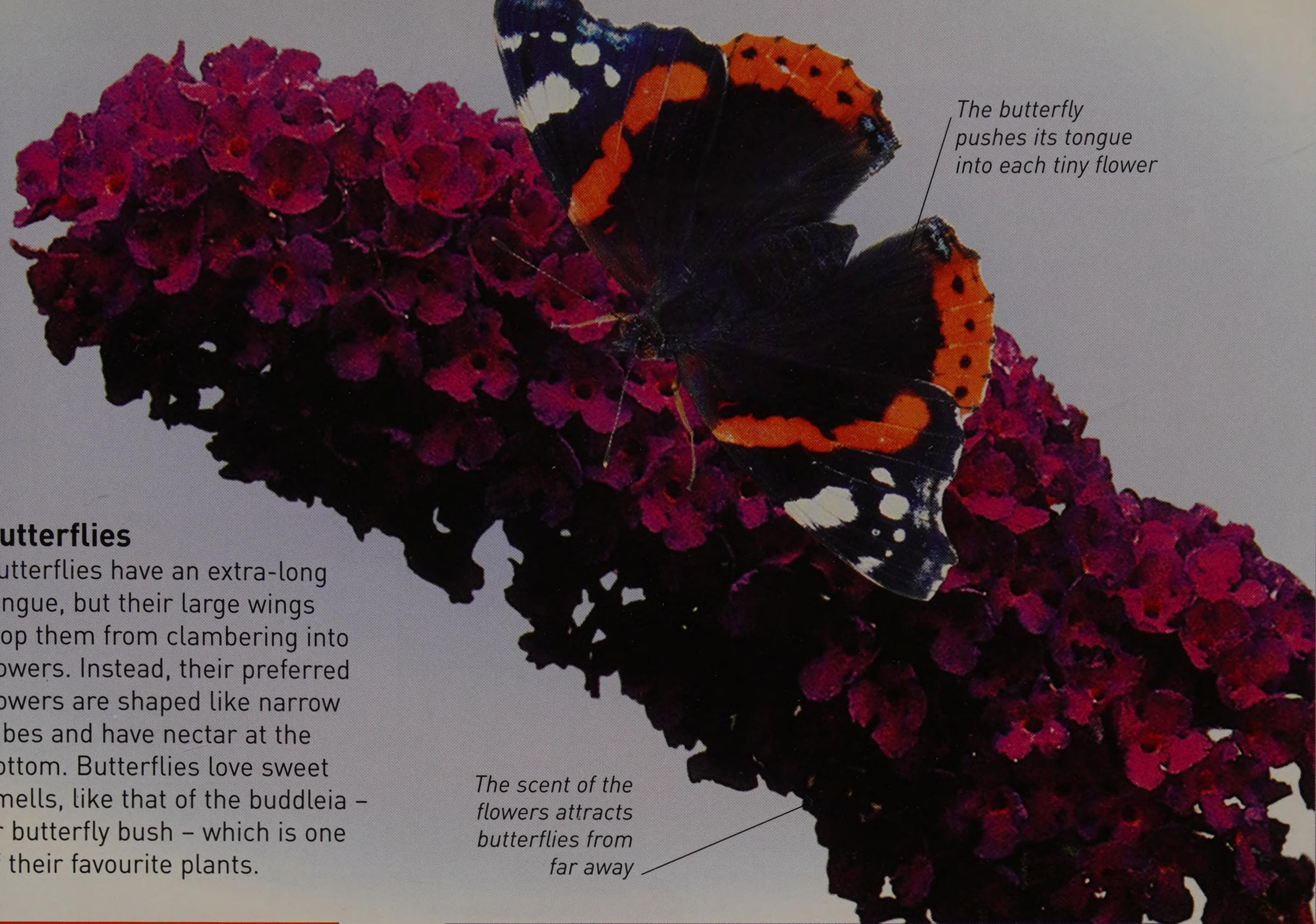
The nectar lies at the bottom of the spur

WHERE TO LOOK

- Bees – on brooms, snapdragons, toadflaxes, and roses
- Butterflies – on buddleia (butterfly bush), thistles, and valerian
- Hoverflies – on hogweed, elder, and yarrow

Bees

This bumblebee has landed on a toadflax flower and is reaching inside to feed. A bumblebee's tongue is very long and can suck up the nectar in the flower's pointed spur, or nectar tube. As well as drinking nectar, bees also eat pollen. They scrape it off their bodies and press it into special baskets on their legs. When their pollen baskets are full, they fly back to their nest.



The butterfly pushes its tongue into each tiny flower

The scent of the flowers attracts butterflies from far away

Butterflies

Butterflies have an extra-long tongue, but their large wings stop them from clambering into flowers. Instead, their preferred flowers are shaped like narrow tubes and have nectar at the bottom. Butterflies love sweet smells, like that of the buddleia – or butterfly bush – which is one of their favourite plants.

IMPORTANT

It is safe to use your magnifying glass to watch bees as they feed, but don't get too close or touch them in case you get stung.



Hoverflies

Hoverflies have short tongues, so they cannot reach into deep flowers. Instead, the flowers they visit are often flat. Unlike bees and butterflies, hoverflies are attracted by strong-smelling flowers, often those that are not so nice to a human nose.

OPENING TIMES



Some flowers stay open 24 hours a day, but many open up only when their insect visitors are about. In the early morning, look out for flowers that are gradually opening as the air warms up. These flowers stay closed all night but open during the day when bees are on the wing. Some flowers work the other way around. They open up in the evening and stay open all night. These late openers are pollinated by moths, and many give off a sweet scent to help moths track them down.

◀ Night shift

Evening primrose flowers open at night. Their pale colour makes them easy for moths to spot in the dark.



Training honeybees

Honeybees are good at finding flowers and remembering where they are. When they get back to their hive, they spread the news by doing a special dance. It shows other bees which direction to fly and how far to go. You can see this system at work by training bees to visit cardboard flowers. Once bees find the flowers, you can test their memories.

WHAT YOU WILL NEED

- Thin cardboard, in five different colours
- Scissors
- Sugar
- Water
- Cup
- Five bottle tops

IMPORTANT

Honeybees can sting. Don't get too close to them when they are feeding. Ask an adult if you or anyone nearby is allergic to bee stings.



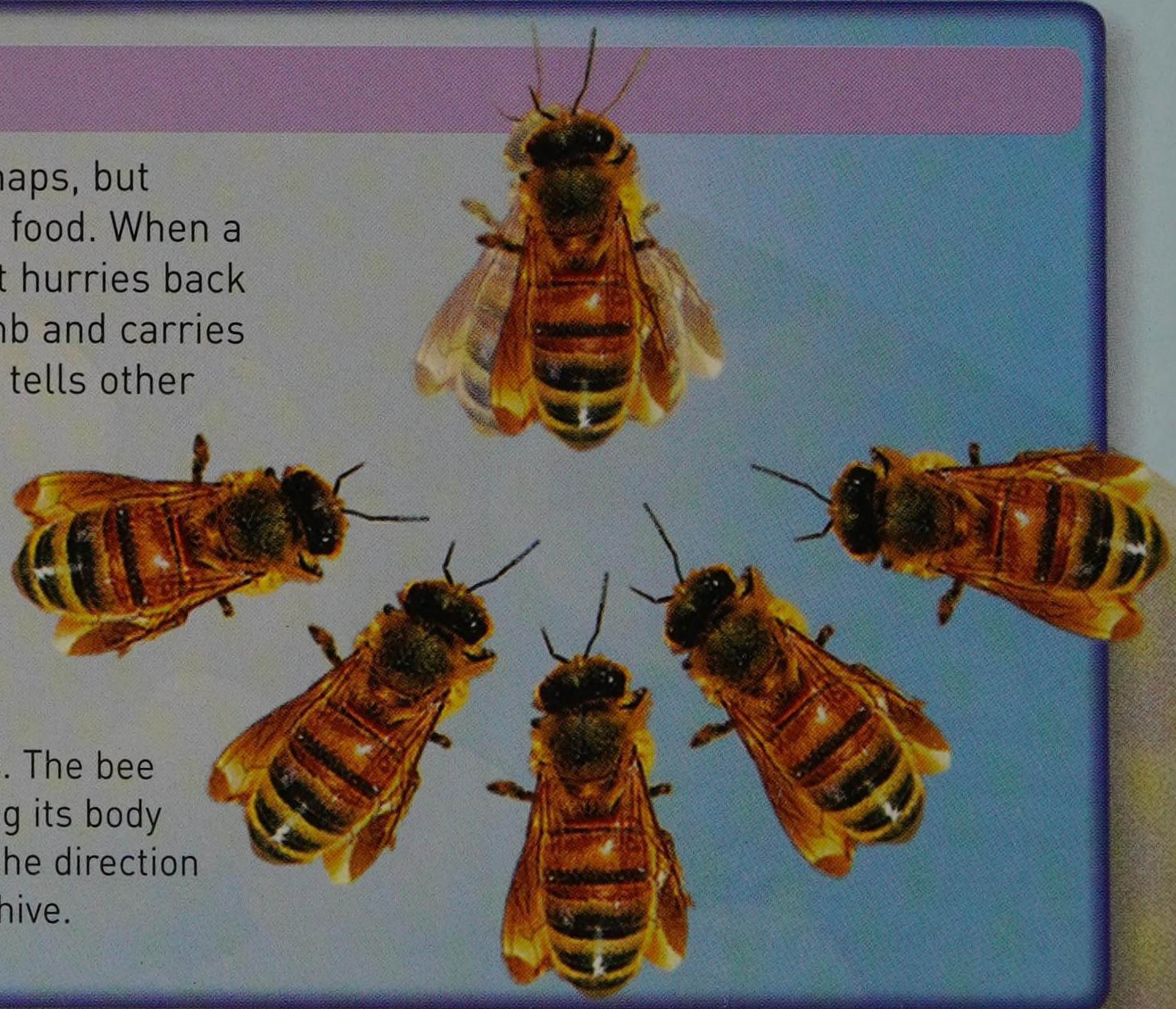
- 1 Cut out five** cardboard flowers – one of each colour. Then mix a solution of sugar and water in a cup.
- 2 Put the flowers** outside in the Sun and place a bottle top in the centre of each one. Put a few drops of sugary water in one of the bottle tops.

DANCING BEES

Bees can't talk and they can't draw maps, but they can tell each other where to find food. When a worker bee finds a patch of flowers, it hurries back to the hive. It crawls onto a honeycomb and carries out a special dance. The round dance tells other workers that the flowers are nearby. The waggle dance shows that they are further away and tells the other worker bees where to find them.

Message in a dance ►

The waggle dance works like a compass. The bee dances in a particular direction, wagging its body as it moves. The other bees remember the direction and follow it when they set off from the hive.



INSIDE A BEEHIVE

A honeybee hive is like a busy city, ruled by a single queen. The queen lays all the eggs and keeps the hive under control. The worker bees build the nest, look after the young bee grubs, and forage for food. Honeybees make honey from nectar to feed to their grubs, and they also use it as food in winter. They store it in the honeycombs, putting several drops in each cell before sealing it with a lid.

Bees on a honeycomb ►

These bees are walking over an empty honeycomb they have just built. The honeycomb is made of wax and contains hundreds of six-sided cells, used for storing honey pollen and raising grubs.



The honeybees lap up the sugar water with their tongues



3 The first bees to arrive will report back to their hive. More bees will arrive at the flower that contains food.

4 Now take away the sugary water. The bees will remember the flower's colour and will keep coming back to it, even though there is no food there.

Bees gather at the empty flower expecting to find food

WHAT YOU WILL NEED

- 20 pieces of bamboo cane, about 1 cm (1/2 in) in diameter and 15 cm (6 in) long
- Strong tape
- Modelling clay
- Plant pot



Ask an adult to help you cut the canes to size.

Bee homes

Honeybees live together in hives, but many other garden bees live alone. They lay their eggs in mini-nests and then leave their grubs to grow up on their own. Some of these bees tunnel into wood, but mason bees often nest in hollow plant stems. Solitary bees pollinate many garden plants, so it is worth encouraging them to breed. You can help mason bees to set up home with a flowerpot and some bamboo canes.

LEAFCUTTER BEES



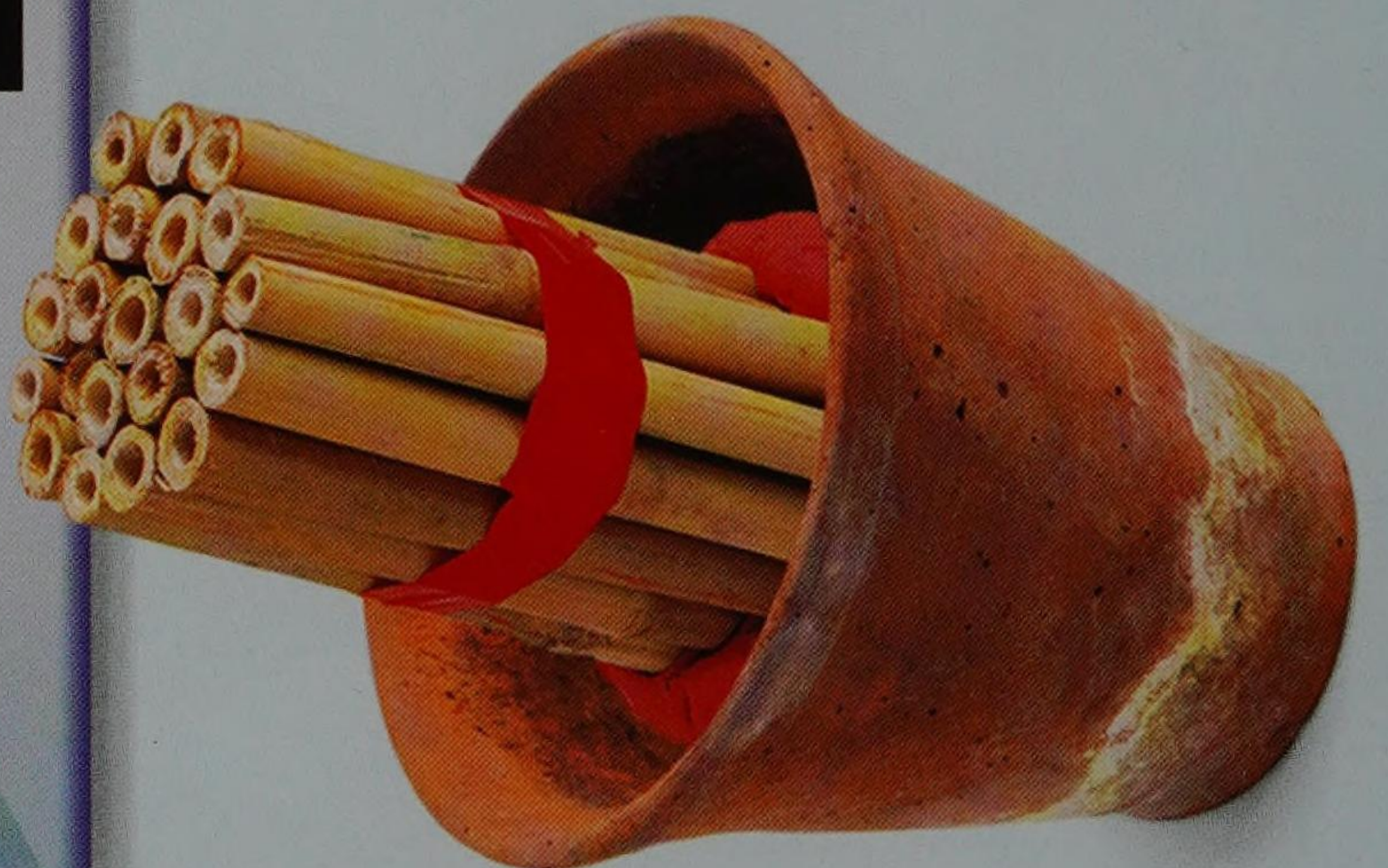
Precision cut ▲

This leafcutter bee is using its sharp jaws to slice a piece out of a rose leaf. When it has finished, it will carry the piece of leaf back to its nest.

In summer, look closely at rose plants and see if you can spot any semi-circular holes in their leaves. These holes are made by leafcutter bees – small insects that nest in hollow stems. Unlike mason bees, leafcutters do not line their nests with mud. Instead, they make small parcels from leaves – rose leaves are by far their favourite kind. Each parcel contains a single egg and a supply of pollen for the developing grub to feed on when it emerges.



- 1 **Stand the pieces** of cane on end to make a bundle. Then bind them together with the tape. Press the canes into a lump of modelling clay to seal one end.



- 2 **Put the canes** into the plant pot, with the open ends facing outwards. Use some more modelling clay to wedge the bundle tightly inside the pot.

CARPENTER BEES

Most solitary bees are small, so they are easy to overlook. Carpenter bees are quite different because some of them are over 2.5 cm (1 in) long. These impressive insects have furry bodies, their wings are often black, and they make a deep buzzing sound when they fly. Most carpenter bees make nests by chewing tunnels in dead wood. The female pats pollen into loaf shapes, lays an egg on each one, and then seals it up.

Big buzzer ►

Carpenter bees live in warm parts of the world. This great carpenter bee is the largest kind of bee in Australia.



- 3 **Leave the pot** in a sunny, dry spot. In the spring, mason bees will line the canes with mud and then lay their eggs.



Insect architects

Insects are some of the finest builders in the animal world. Unlike human builders, they do not have to learn how to carry out their work. Instead, their instincts tell them what plan to follow, and what materials to use. Bees often make their nests from wax, but other insects use wood fibres, leaves, or clay. If you look carefully, you may be able to spot insects collecting building materials before heading back to their nests.



The centre of the nest contains small cells, where the queen lays her eggs

ANT NESTS



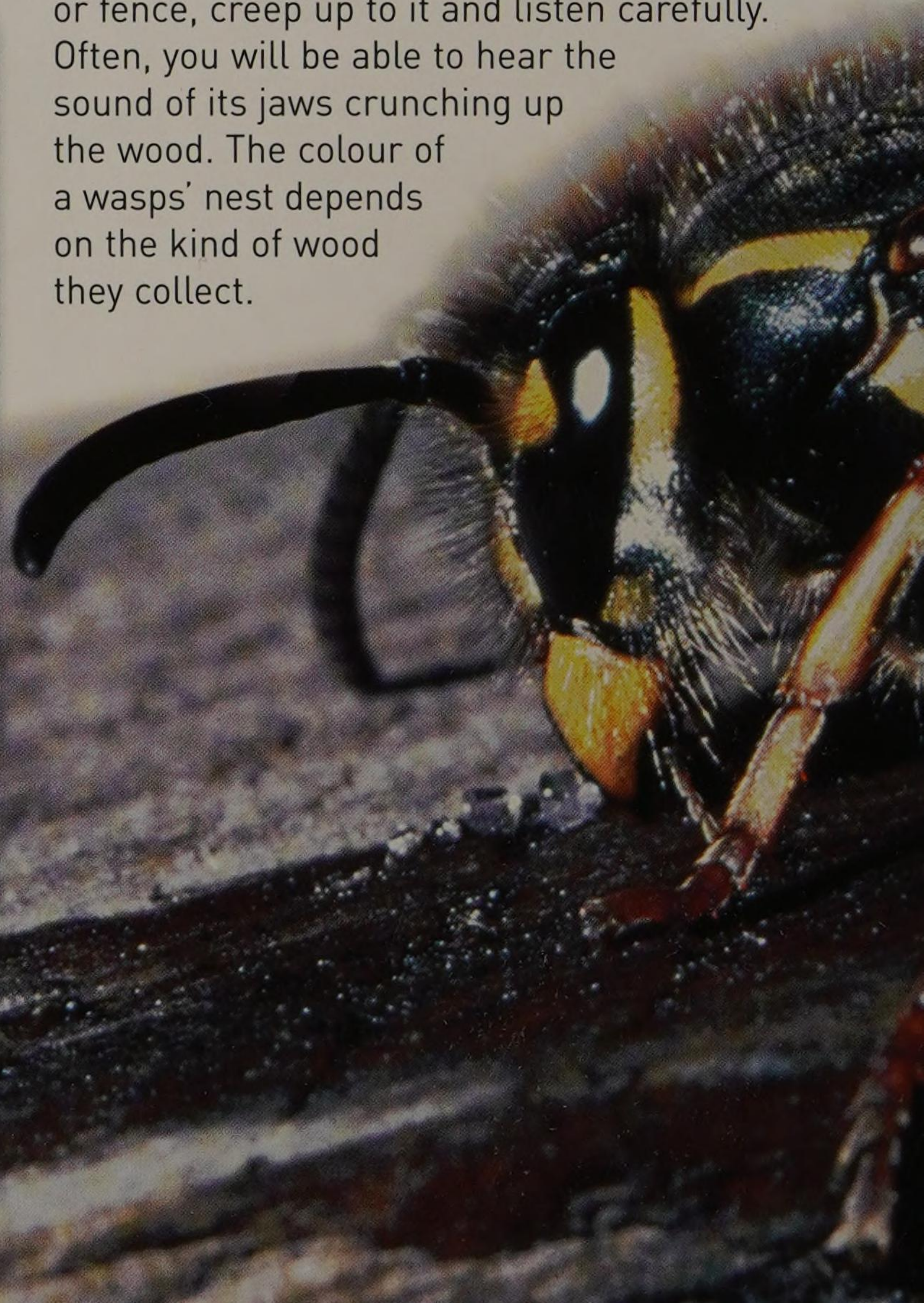
Wood ants ▲

These ants make nests from pine needles and twigs. One nest can contain thousands of ants.

Ants are among the world's most successful insects. They live in forests, grasslands, and towns and cities. Some ants make nests from piles of leaves, but most nest under fallen logs, or underground. If you accidentally disturb an ants' nest, watch how the ants quickly carry their grubs away to safety.

Crunch time

If you see a wasp sitting still on a wooden post or fence, creep up to it and listen carefully. Often, you will be able to hear the sound of its jaws crunching up the wood. The colour of a wasps' nest depends on the kind of wood they collect.



The thin paper walls of the nest look like a series of overlapping shells

Paper homes

Common wasps build their nests from fibres of dead wood. They chew up the fibres, mix them with spit, and then spread them out to make a kind of paper. The queen lays her eggs inside the nest. Worker wasps maintain the nest and enlarge it by building extra walls.

Wasps scrape and chew at the wood, mixing the fibres with their saliva

TERMITE NESTS



Cool homes ▲

Compass termites make flat-sided nests that stay cool when the Sun is overhead.

Termites build the biggest nests in the insect world. Some make their nests from wood fibres, but the most impressive nests are made of clay. The clay is soft when the termites build the nest, but it turns hard as it bakes in the Sun.

IMPORTANT

Wasps and ants defend their nests fiercely, so keep your distance if you see one – or you will risk getting stung or bitten.

On the trail

Ants are hard-working insects and they scout far and wide in search of food. If one ant discovers something tasty, others soon arrive to help take the food back to the nest. Ants have very bad eyesight but a keen sense of smell. Wherever they walk, they leave a trail of scent so they never get lost. If you give ants some food, you can see how quickly they sniff it out, spread the news, and carry it back down the trail to their nest.

WHAT YOU WILL NEED

- Crumbs (bread, biscuits, cereals, crisps etc.)
- Magnifying glass
- Small stick or stone
- Watch

1 Look for a trail of ants in your backyard or garden. When you find one, put some crumbs nearby. Next, put a small stick or stone 1 m (3¼ ft) back down the trail. When the ants find the food, check the time on your watch.

2 Stand well back from the ants and watch them as they carry the food away. When they get past the marker, check the time again. From this, you can tell how long it takes them to travel 1 m (3¼ ft) carrying their load.

Worker ants grip the food in their jaws



MEETING AND GREETING

If you watch ants on a trail, you will notice that they often touch each other with their antennae when they meet. They do this as an identity check, and also to swap news about food. Every ant has a smell, which it gets from its nest. If an ant meets another ant with the same smell, it knows that it is a friend and is not from a different nest. Ants also smell of the food they collect, so other ants can tell what they have found.

Getting together ►

These two red ants are touching each other's antennae. They use their antennae to smell each other as well as to test any food that they find.



FLYING ANTS

In warm weather, watch out for flying ants swarming into the air. These winged ants grow up in the safety of the nest, where they are looked after by worker ants. When the weather is right, the workers let them out so they can fly off to start nests of their own. If you see flying ants taking off, look for birds swooping in to enjoy this feast of flying food.

Airborne ►

These winged ants have crawled up a plant and are taking off. The males die soon after mating. The females shed their wings after they land, and then look for somewhere to make a nest.



The ants work as a team to carry the food back to their nest

HANDY TIP

When you are watching ants, don't put your feet too close to their trail.

Ants use their antennae to smell their way back to the nest

Friends and enemies

Aphids, or greenfly, are among the fastest-breeding bugs on Earth. They live by sucking sap from plants and are easy to find because they cannot run away. Aphids have lots of enemies, but they are not as helpless as they seem. They are protected by ants, which work like a team of security guards. If you find some aphids, take a closer look. You will often see ants scurrying around them and even over their backs. In return for protection, the ants receive drops of sugary honeydew.

Teaming up

This ant is collecting drops of honeydew from an aphid. Aphids produce honeydew as they feed, and ants collect it and take it to their nests. If any other insects come near the aphids, the ants attack them and chase them away.

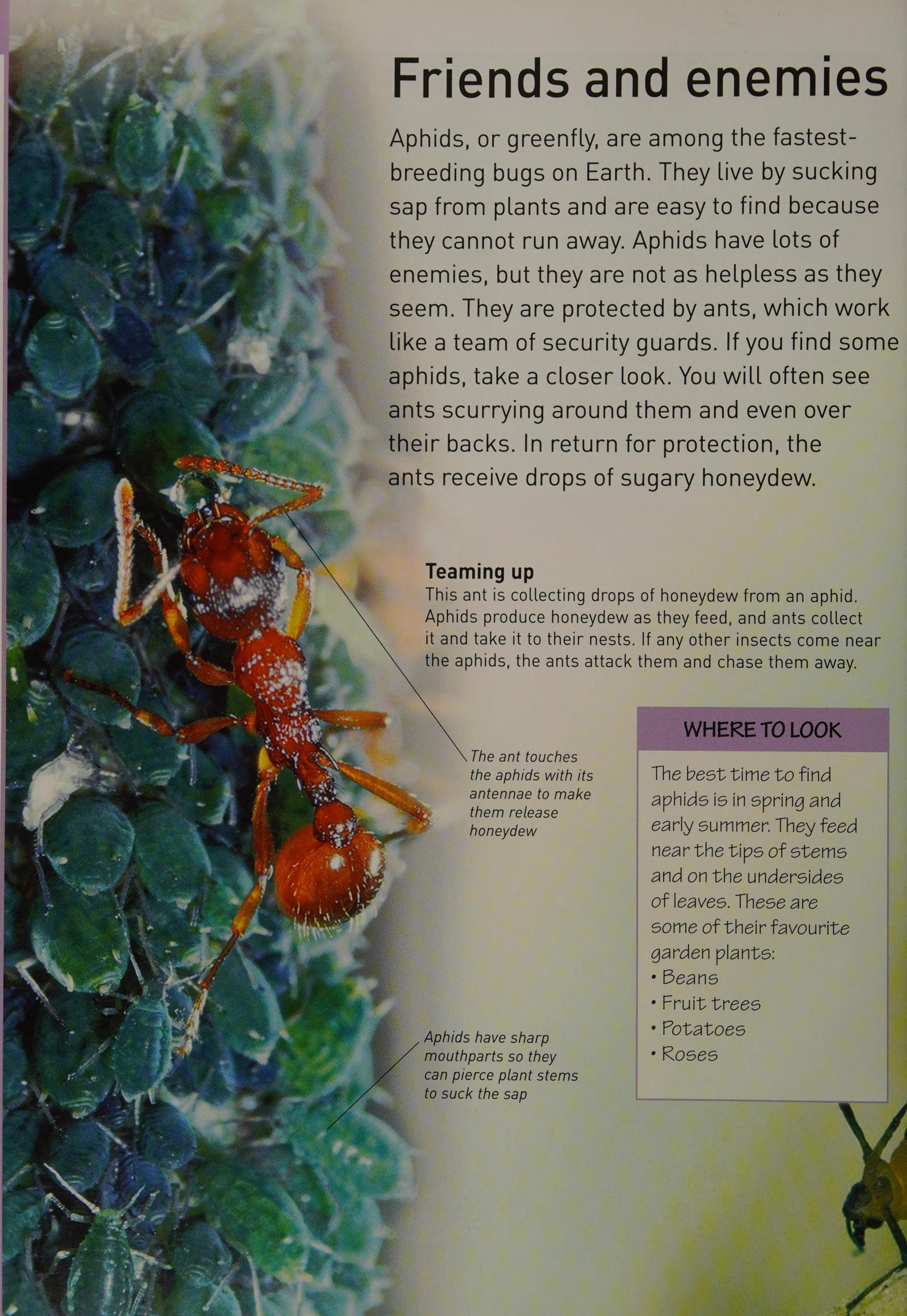
The ant touches the aphids with its antennae to make them release honeydew

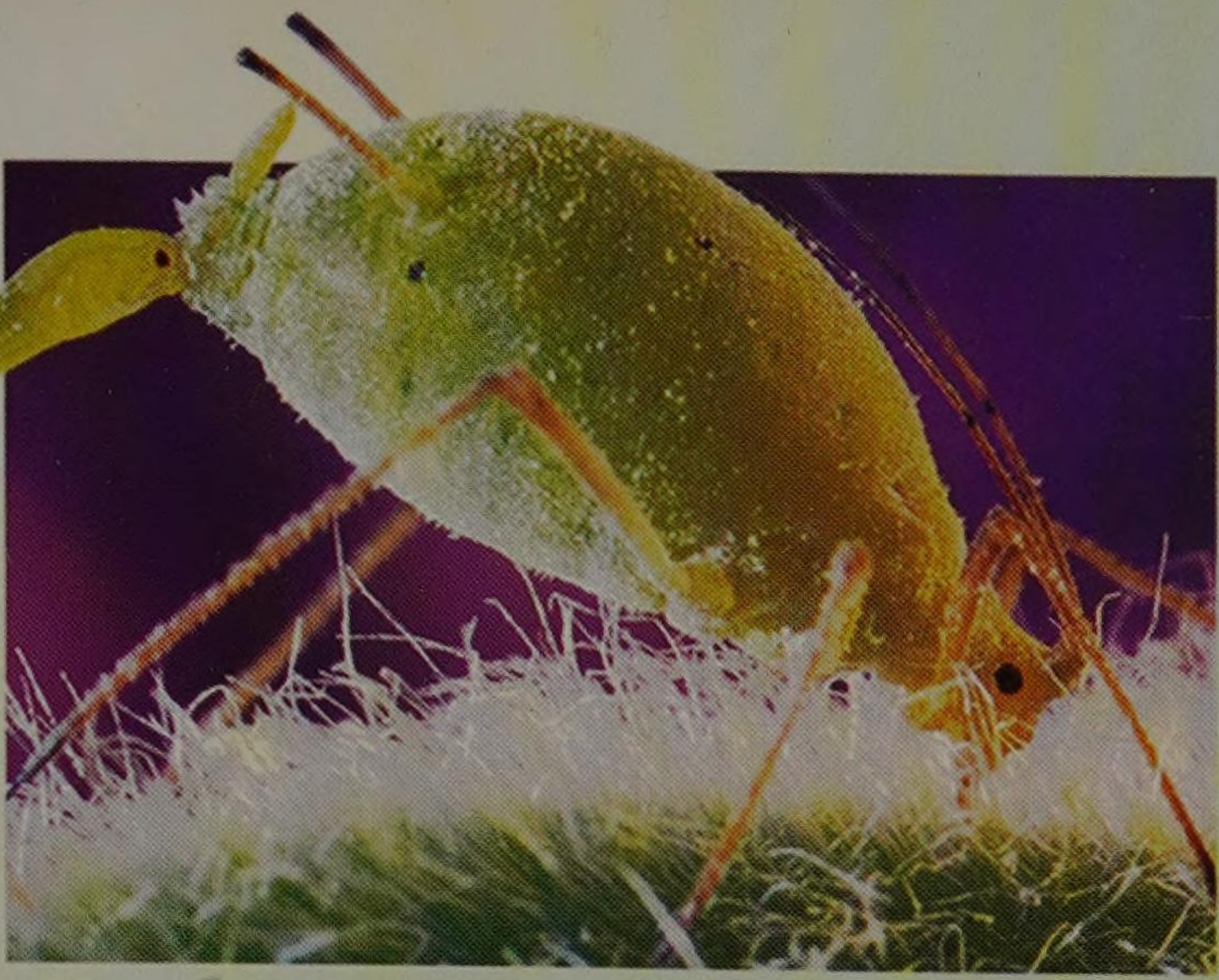
Aphids have sharp mouthparts so they can pierce plant stems to suck the sap

WHERE TO LOOK

The best time to find aphids is in spring and early summer. They feed near the tips of stems and on the undersides of leaves. These are some of their favourite garden plants:

- Beans
- Fruit trees
- Potatoes
- Roses





Booming families

Most insects breed by laying eggs, but aphids often give birth to live young. This female is producing a baby while she feeds. In spring and summer, female aphids often have several babies a day. A few weeks later, they are surrounded by many fast-growing young. Unlike most insects, aphids can reproduce without mating.

Aphid eaters

Ladybirds and their grubs are very useful garden insects because they help to keep aphids under control. Other aphid enemies include lacewings and tiny parasitic wasps that lay their eggs inside aphids' bodies. These predators and parasites are not put off by the aphids' security guards.

HONEYDEW

Aphids suck up several times their own weight of sap every day. Once they have digested it, lots of sugar and water is left behind. Aphids get rid of this sugary liquid by producing droplets of honeydew. If you stand under a tree that is full of aphids, you may feel a honeydew mist landing on your face. Honeydew leaves shiny smudges on leaves and sticky blotches on parked cars.



Hungry helpers ▲

If honeydew collects on leaves, it encourages the growth of a mould that is harmful to aphids.

Hungry ants prevent this from happening.



Growing a home

Some insect grubs have a clever way of keeping out of sight – they release chemicals that make plants grow them a home. These homes are called galls and they often look like small buttons or fruit. The grubs live inside the galls and use their juicy flesh as food. When the grubs have grown up, they crawl out and fly away. You can find galls on all sorts of plants, including trees, bushes, and garden weeds. If you collect some galls, you can open them up to see if any grubs are still inside.

Cherry galls develop on the underside of oak leaves

WHAT YOU WILL NEED

- Selection of galls from various plants
- Sharp knife
- Chopping board
- Magnifying glass

Ask an adult to help you cut open the galls.

Some are hard and must be opened carefully.



1 Search for galls on leaves and on the tips of stems and small twigs. Pick the leaf or twig carefully. Oak trees are great places to start looking because many kinds of gall insect live on them.

2 Look at the gall to see if you can spot a hole. If there is one, it means that the gall grub has already grown up and flown away. If you cannot see a hole, cut open the gall and you may find a gall grub inside.

The gall's spongy flesh hides the grub and gives it something to eat

The grub lives in the middle of the gall and feeds on it as it grows up



PLANT PROTECTION

In warm parts of the world, some ants spend all their lives in trees. The ants make their nest in hollow galls, and the tree gives them all the food they need. In return, the ants work like armed guards. If an animal tries to eat the tree's leaves, the ants pour out of their nest. They bite and sting the intruder until it gives up and goes away.



Whistling thorn ▲

This African tree has hollow galls at the base of its thorns. Ants set up home inside them, nibbling a hole to make an entrance. When the wind blows, the galls sometimes make a whistling sound.

Attack from outside

Gall bugs are safe from birds but not from other insects. If you look at galls while they are still on plants, you may sometimes spot flies or wasps laying their eggs inside. Fly grubs eat the gall itself, but wasp grubs are parasites – they feed on the grub that made the gall.

This parasitic wasp lays its eggs in oak marble galls

The wasp bores into the gall with its ovipositor (egg-laying tube)

HANDY TIP

In autumn, look for galls on bare twigs and the underside of fallen leaves.

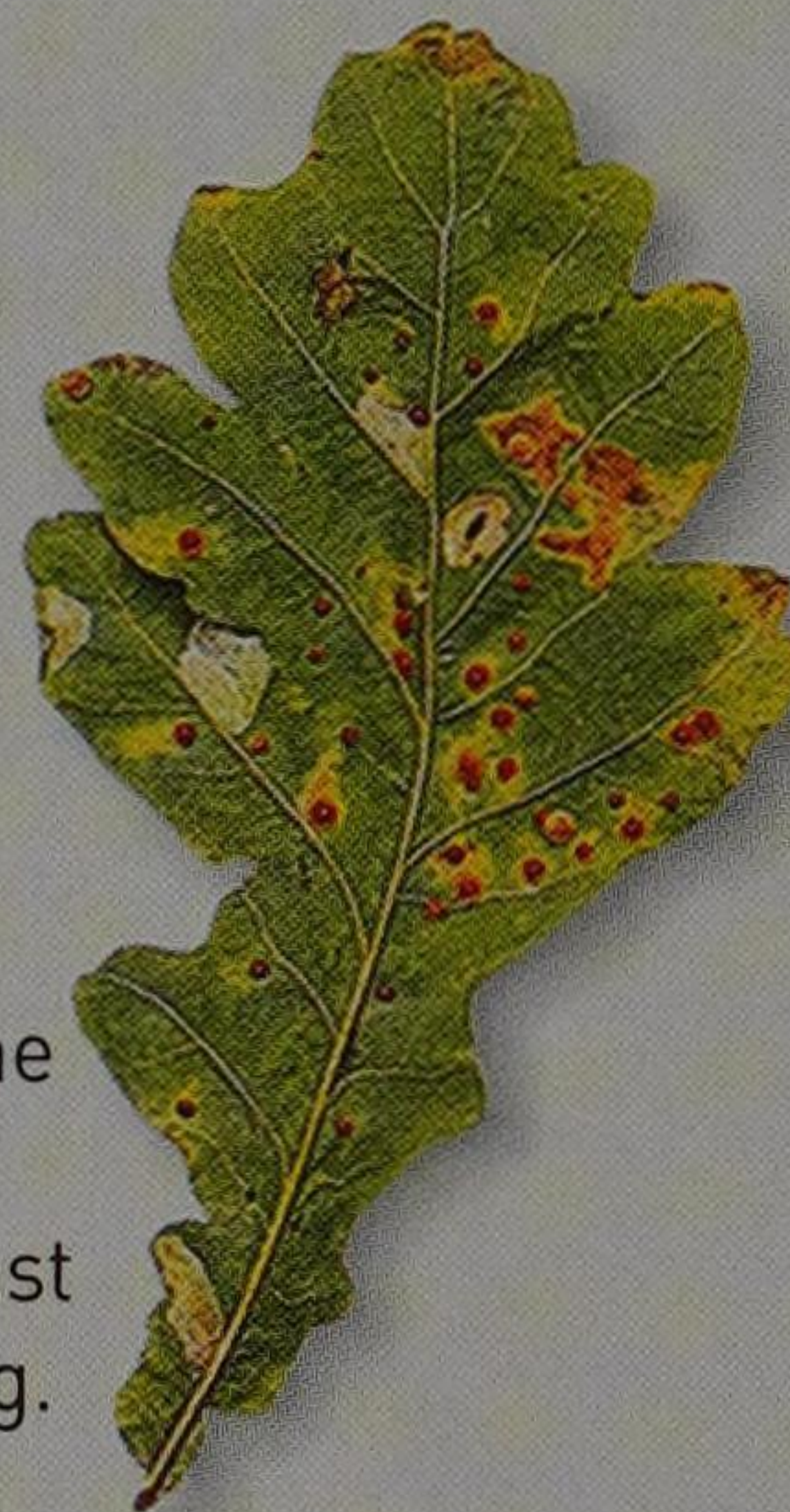
Oak marble galls look like small wooden fruit

Gall types

Gall bugs are fussy about where they live. Each kind lives on just one kind of plant and always makes the same kind of gall. Some galls are soft and do not last for long. Others turn hard and woody as the summer wears on. These hard galls are ideal for collecting and keeping.

Spangle galls ►

These soft galls grow in clusters on the underside of oak leaves. Each one looks like a small button fastened by a tiny stalk. The wasps that make these galls are just 3 mm (0.1 in) long.



Knopper galls ►

Instead of growing on leaves, knopper galls grow on acorns. They are easy to spot because they are large and knobby, and they stay on the tree for a long time.



Bedeguar galls ▲

These galls grow on wild roses. The outside of the galls is soft and furry but the inside is hard, like wood. Each gall contains lots of grubs.



Mines and galleries

Some young insects, or larvae, live inside leaves and wood. Here, they can munch their way through their food with little danger of being spotted and eaten. It is not easy to find the larvae themselves, but you can look out for the tell-tale signs that they leave behind. Leaf-eaters often make wiggly mines, while bark beetles dig out tunnels called galleries in dead and dying trees.

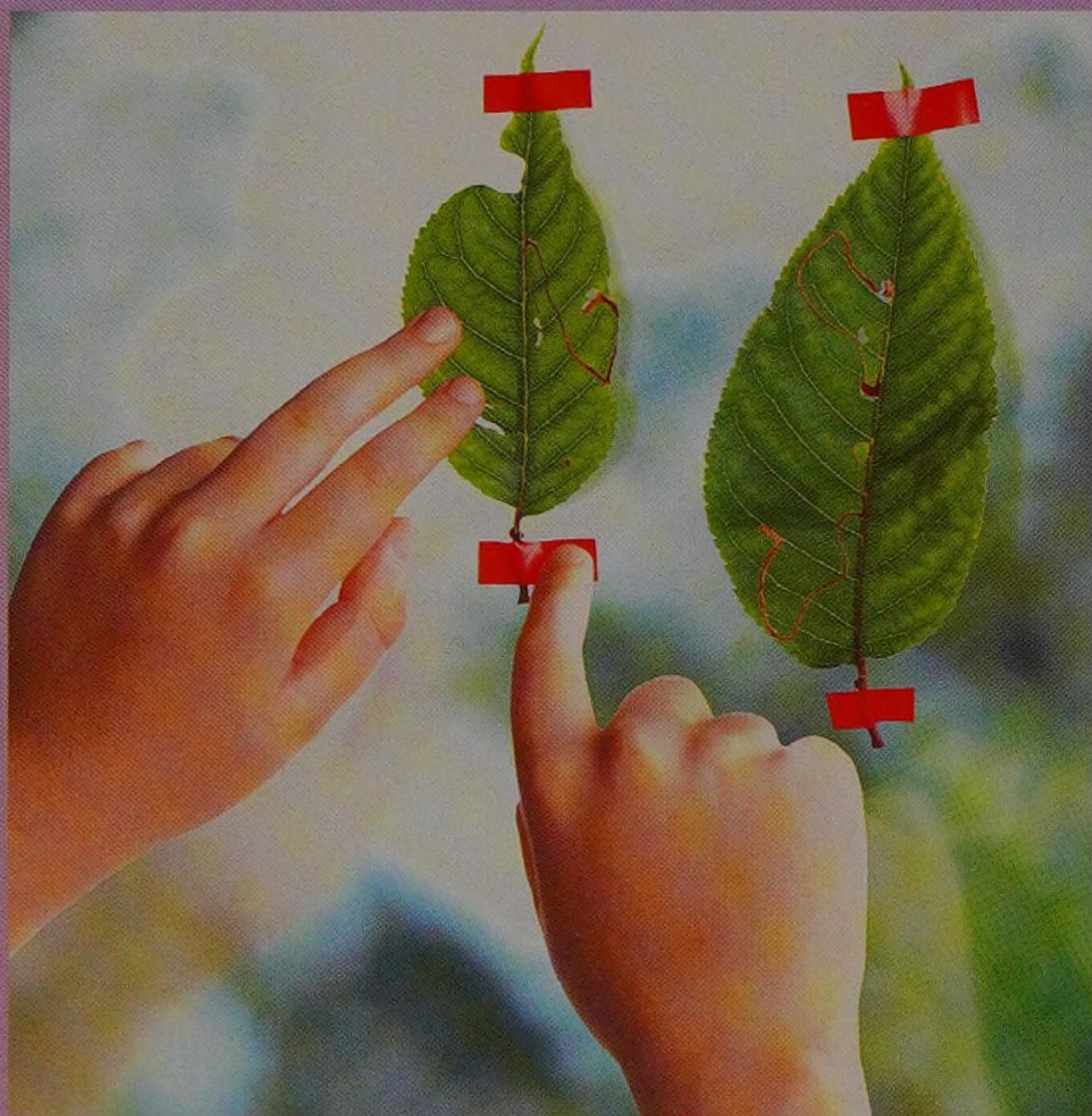
The caterpillar left the leaf here

This apple leaf has been mined by the caterpillar of a small moth

Leaf miners

Leaf miners are tiny larvae that live between the top and bottom surfaces of leaves. As they feed, they move through the leaf, leaving a track called a mine. The mine gets wider as the larva grows, and stops where the larva climbs out to turn into an adult insect.

LOOKING AT LEAF MINES



Leaf miners attack many different plants, but brambles and fruit trees are their particular favourites. If you look at these plants in summer and early autumn, the mines are often easy to spot. To get an even better view, collect some leaves with mines and fasten them to the inside of a window with some sticky tape. Because the mines are hollow, they will appear paler than the rest of the leaf. Look carefully at the thickest end of the mine to see if the caterpillar is still inside.

◀ Leaf mines on show

If you make a leaf mine collection, you will be able to see differences in the way the mines are made. Some miners wander all over a leaf. Others stick to one area and chew out a single block.



Leaf miner larva

This leaf miner is chewing its way through an oak leaf.

As it feeds, it leaves a trail of droppings in the middle of the mine. The commonest kinds of leaf miner are moth caterpillars, but they also include the larvae of beetles and flies.

The mine starts where an adult moth lays an egg

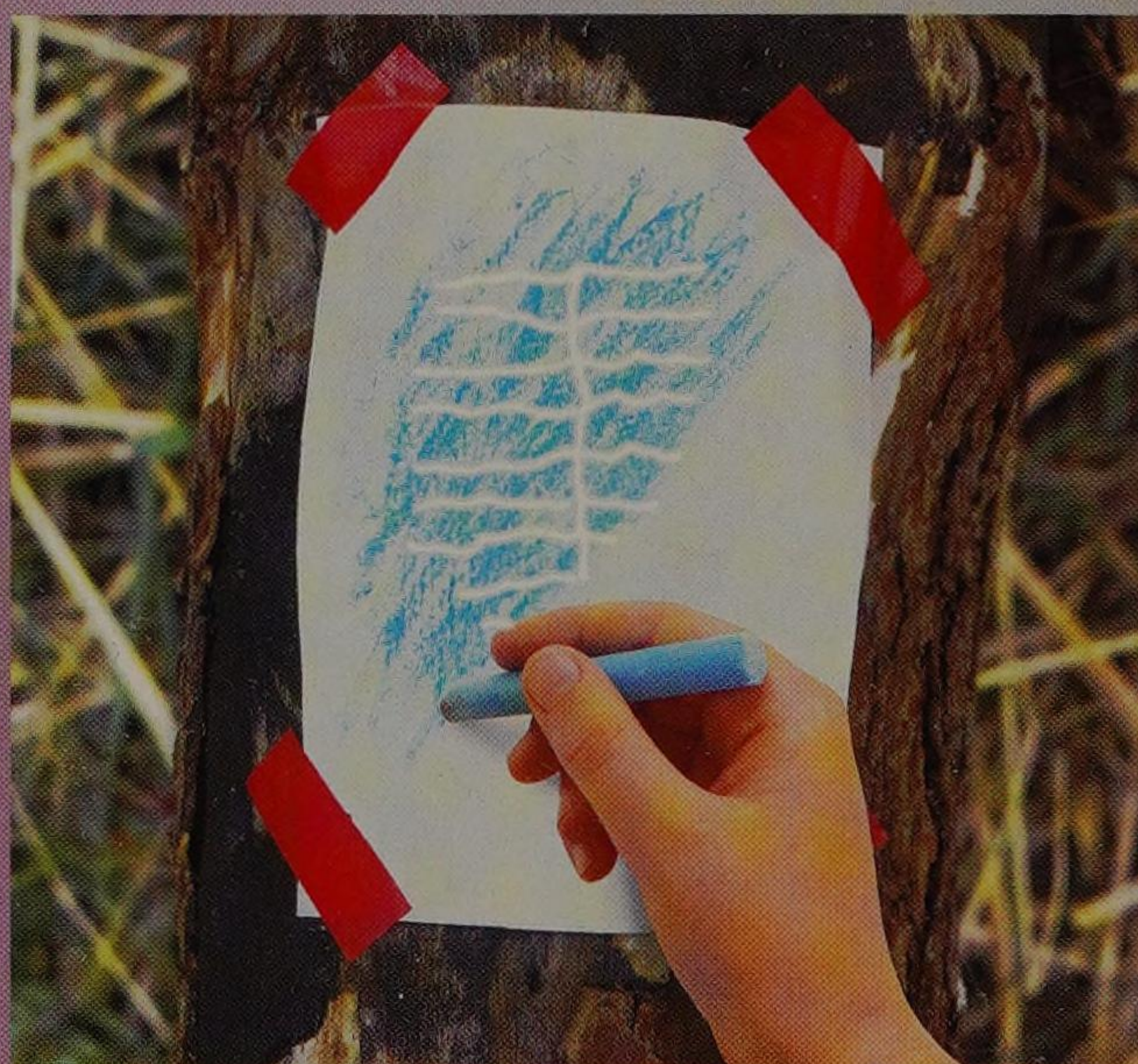


Tree galleries

Bark beetle larvae feed on wood, chewing tunnels, or galleries, beneath a tree's bark. To find their galleries, look at dead trees and large pieces of fallen bark. Most galleries are made up of lots of separate tunnels spreading out like slender fingers. Each tunnel is made by a single larva.

BARK RUBBING

Beetle galleries have lots of interesting patterns because bark beetle larvae dig in different ways. Some galleries have tunnels in parallel lines, while others spread out through the wood like stars. You can record different types by making rubbings with a wax crayon. Find a gallery and brush away any dust or loose wood. Tape a sheet of white paper on top of it, then rub the crayon gently over the paper.



▲ Making a rubbing

To make really good rubbings, use a thick crayon and do not press too hard.

Fun with flies

Flies aren't popular insects. Some of them bite, while others buzz around and land on food. But not all flies are troublesome. Fruit flies are tiny and harmless, and they are easy to raise. All you have to do is attract adult flies with some over-ripe fruit. If you keep the fruit in a warm place, their eggs will turn into adults in just seven days.

That's about a thousand times faster than humans grow up!

WHAT YOU WILL NEED

- Over-ripe banana
- Knife
- Chopping board
- Large jam jar
- Piece of muslin 10 cm (4 in) square
- Strong elastic band



- 1** Chop the banana into thick slices – there's no need to peel it first.

IMPORTANT

Don't forget to empty the jam jar when you have finished observing the fruit flies. Tip the contents on to a compost heap if you can.



- 2** Put the slices in the jar and leave the jar in a warm, sunny spot near an open window. Fruit flies will be attracted to the banana and will lay their eggs on it. After 24 hours, cover the top of the jar with the muslin and fasten it with the elastic band.



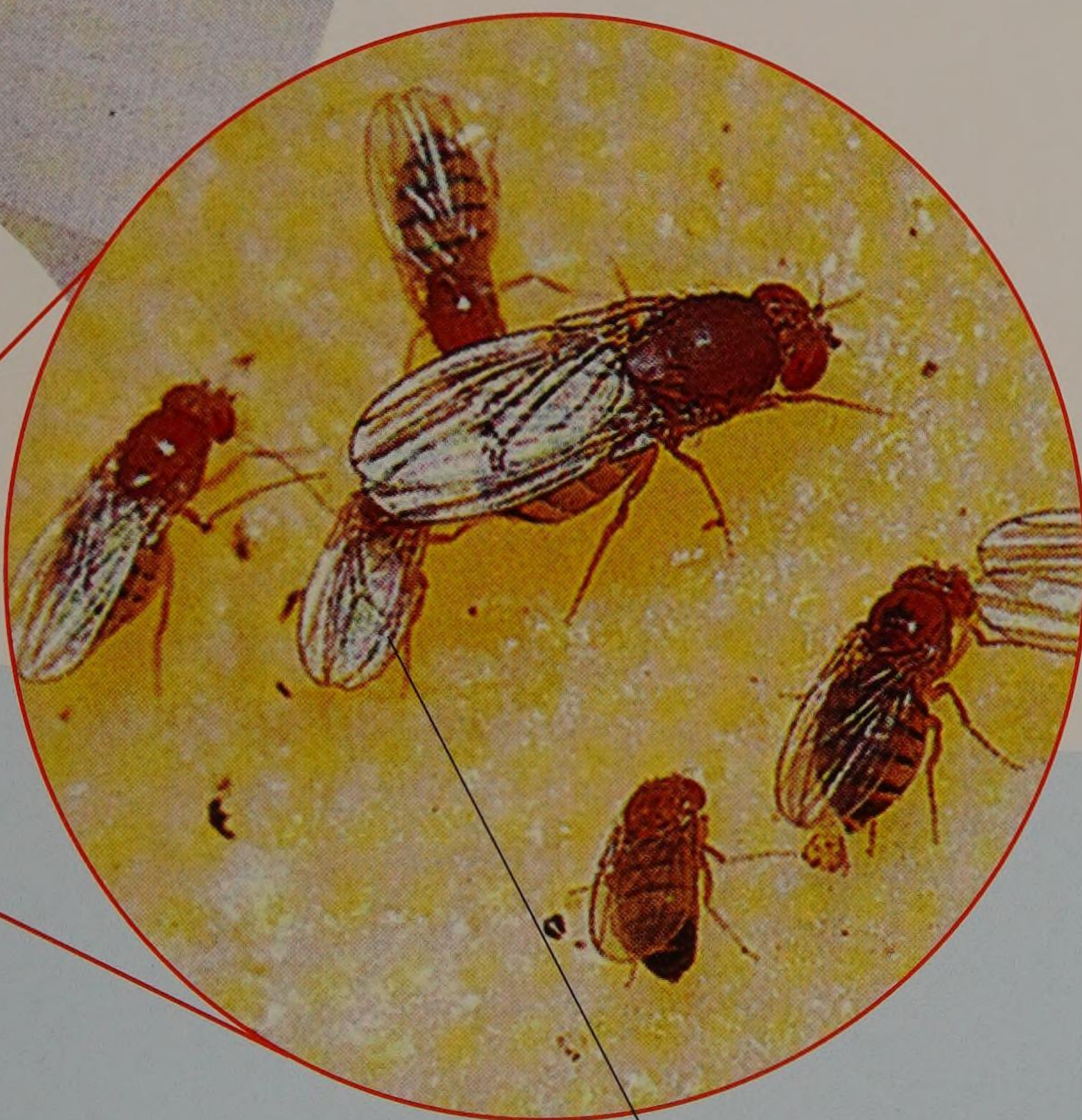
FLY EYES

Fruit flies are only about 5 mm ($\frac{1}{8}$ in) long, so you need good eyesight to see them on the wing. If you really want to test your vision, try taking a close look at the flies' eyes – they are often brightly coloured. Fruit flies have good eyesight, but they find their food mainly by smell. They love things with a fruity or sweet scent, which is why you can often spot them hovering around glasses of fruit juice or wine.



▲ Looking at you

Viewed in close-up, a fruit fly's eyes are striking. They are often bright red or blue.



3

Look at the jar every day over the next two weeks. When the eggs have hatched, adult fruit flies will start to appear.

Adult fruit flies suck up sugary juices from rotting fruit

Problem flies

There are more than 120,000 types of flies in the world, which makes them one of the largest and most important groups of insects. Unlike most other flying insects, true flies have just one pair of wings. Many flies are harmless, but some of them are serious pests.



House fly ▲

This fly is one of the world's most widespread insects. Adult house flies feed on anything sweet, using sponge-like mouthparts. They dribble on their food when they eat, and can spread germs on their feet.



Mosquito ▲

Male mosquitoes eat nectar, but females feed by sucking blood. The females have sharp mouthparts that pierce skin like a syringe. Most types are harmless, although their bites itch. But some spread diseases, such as malaria.



Horse fly ▲

Horse flies feed on blood and have a painful bite. Their sharp jaws cut skin open and make it bleed. These flies can be a problem for horses, other farm animals, and even people.

Soaking up the Sun

Unlike humans, insects need warmth to keep on the move. On hot days, they move about at top speed. This makes them difficult to follow and even harder to catch. But if it gets cold, they move much more slowly or even come to a stop. If you are bugwatching, one of the best times to study insects is when the Sun is coming up in the morning. In the strengthening light, lots of insects sunbathe to get their bodies warm.

WHERE TO LOOK

- Insects warming up – the tops of plants; on bare ground facing the morning sunshine
- Insects cooling down – shaded places; where the soil is damp
- Insects hibernating – under bark and stones; in garages and sheds

Sunbathing beauty

This morpho butterfly has opened its wings wide to soak up the warmth of the Sun. Its wings work like solar panels, collecting lots of heat. Later in the day, when the air is warm, the butterfly will rest with its wings closed, making it harder to spot.



The butterfly's wings collect warmth and carry it towards its body. Dark areas are good at absorbing heat

SPEEDING UP

Warmth doesn't only make insects move faster – it also makes them grow up more quickly. If the temperature is 15 °C (59 °F), a bluebottle can take seven weeks to grow up and lay its eggs. But if the temperature is 30 °C (86 °F), it can speed through its life cycle in just 16 days. This is why summer is the busiest time for bugs.

Bluebottle larvae ▼

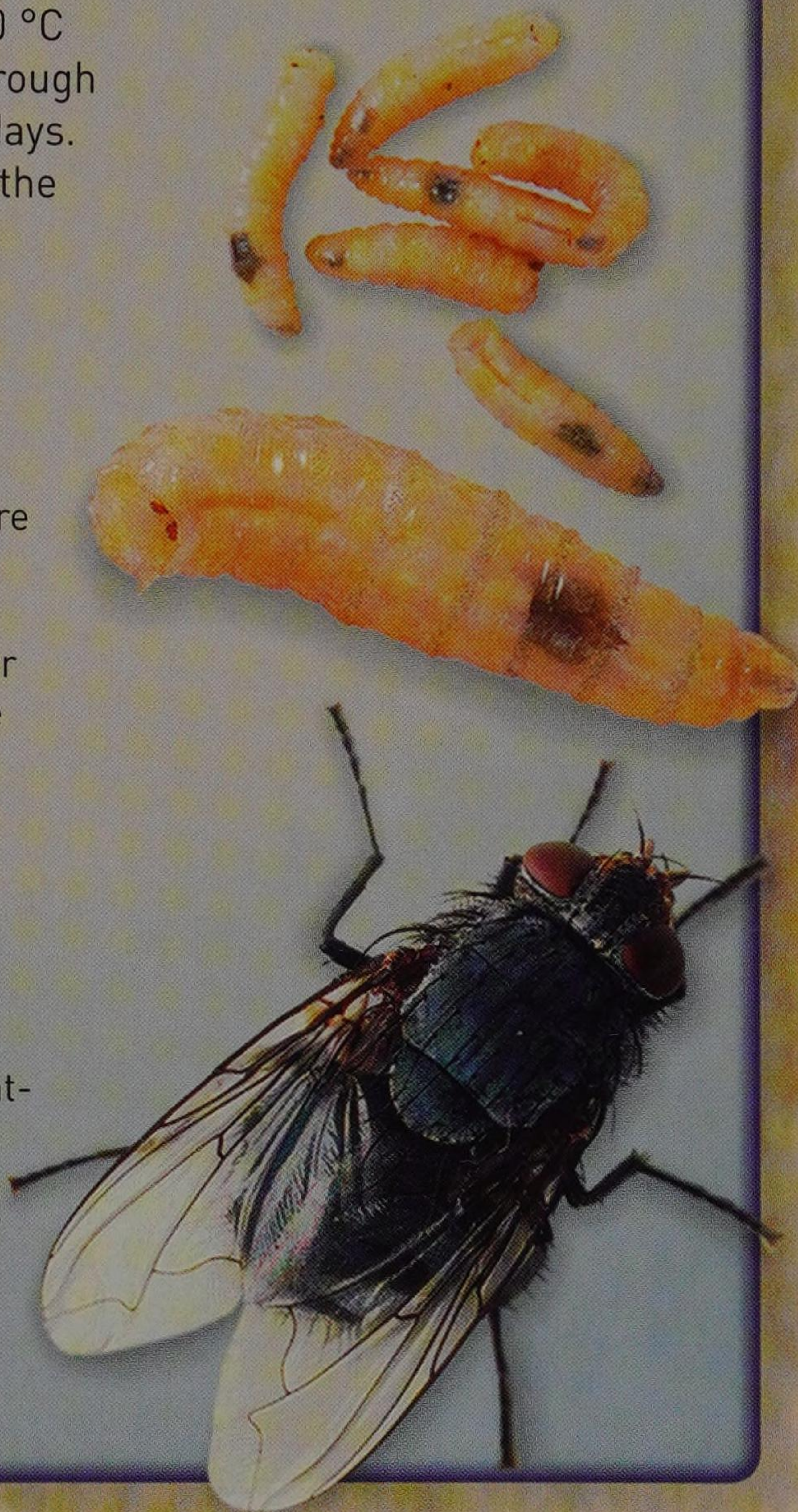
Bluebottles, or blow flies, lay their eggs on meat. In hot weather, the eggs hatch in less than a day. The fly's larvae, or maggots, immediately start to feed.

Growing up ►

Bluebottle maggots feed for just over a week before turning into pupae. If the weather is hot, the adult flies emerge three or four days later. Soon, they are ready to breed.

Adult bluebottle ►

If the warm weather lasts, an adult bluebottle can become a great-great-grandparent in just two months. But when the weather turns cold, the flies stop breeding, and their numbers start to fall.



Hibernation

In winter, hardly any insects are on the wing. Most of them are hibernating until warmer times return. Many spend the winter as eggs or grubs, but some hibernate as adults. These ladybirds are hibernating on a tree. Many other insects hibernate under bark.



Freshwater insects

Ponds and streams are great places to watch insects. Pond skaters skim across the surface, while all kinds of bugs and creepy crawlies swim beneath it. Some of these insects are full-time water animals, but many leave the water when they have grown up. Freshwater insects are easy to catch with a net, but you can watch many of them with no equipment at all. Just wait quietly by the water's edge and watch them come to the surface to breathe.

Back legs work like rudders, steering the pond skater from behind

Pond skater skimming on water surface

Feet spread the pond skater's weight over the surface film

Front legs detect ripples from drowning insects

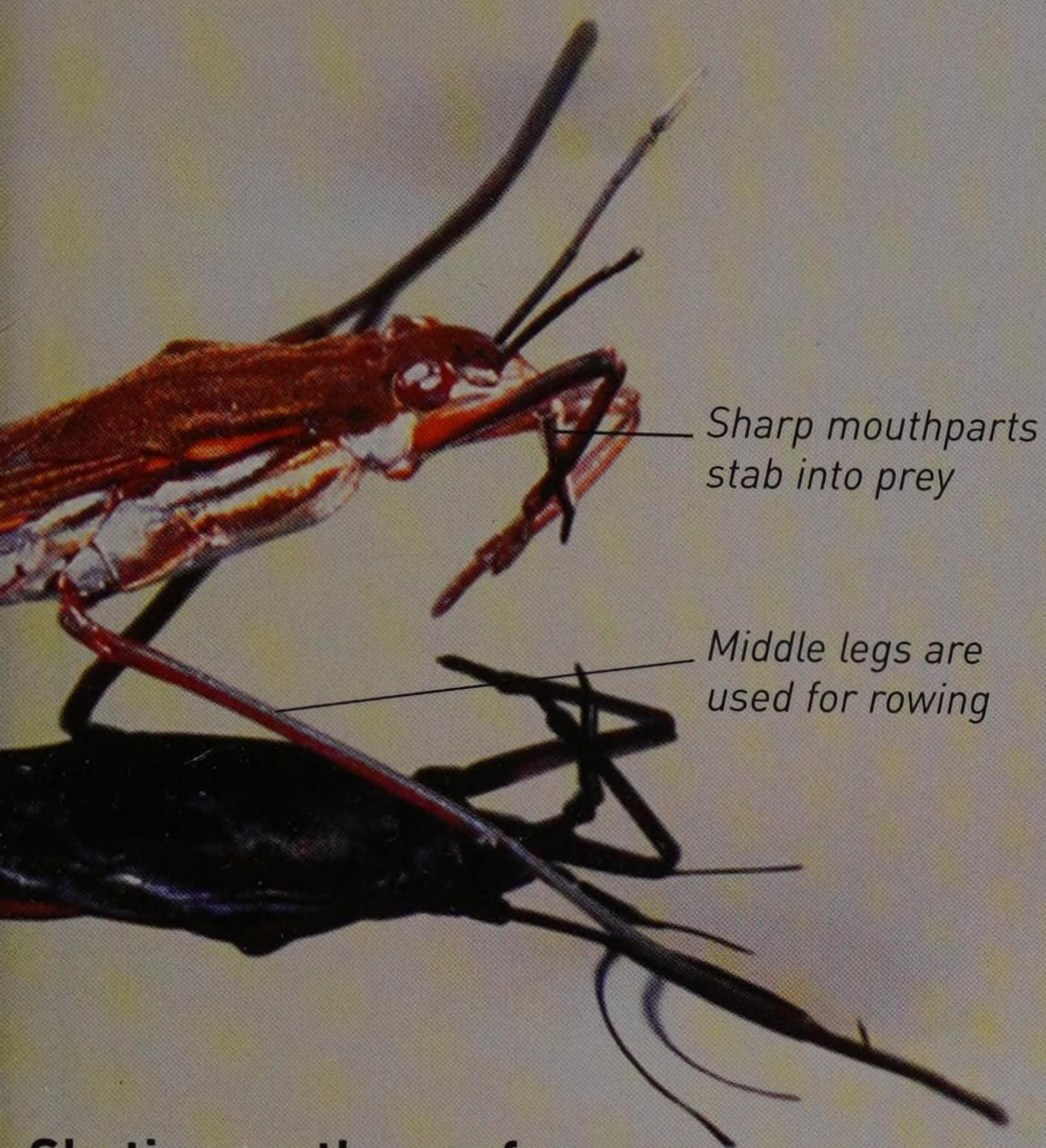
TESTING SURFACE TENSION



To find out why pond skaters don't sink, try this simple experiment. Fill a bowl with water and wait until the surface is completely still. Next, pick up a small paperclip with a pair of tweezers and gently lower it on to the water. Because the paperclip is light, it will sit on the water's surface film. Pond skaters float in exactly the same way.

◀ Floating paperclips

Surface tension gives water a filmy surface. It can hold up light objects, such as a paperclip, but anything heavy breaks through it and sinks.



Sharp mouthparts
stab into prey

Middle legs are
used for rowing

Skating on the surface

Pond skaters are carnivorous bugs that literally walk on water. They have water-repellent feet and they skate on the surface film, which keeps them high and dry. Pond skaters pounce on other insects that have crash-landed, stabbing them with their jaws.



Leaving the water

After two years underwater, this young damselfly has climbed out to start adult life. It sheds its skin for a final time and then unfolds its wings so that it can fly away. To see this amazing transformation, visit a pond on a still summer morning. This is when most damselflies and dragonflies emerge.

UP AND AWAY



Water boatmen underwater ▲

Most underwater insects have wings and some are powerful fliers. Water boatmen, like the two shown here, often fly from pond to pond when the weather is warm. To see this for yourself, use a net to catch one and then put it on the ground. Be careful not to touch it because it may bite. If it cannot scuttle back into the water, it will wait until it is dry and then suddenly take to the air and fly away.



Coming up for air

Old watertanks and cattle troughs are good places for seeing how freshwater insects breathe. Mosquito larvae use tiny snorkels. They will dive down when they see you approach, but come back up in a few minutes.

Spiders

Many people don't like spiders – especially ones that have long, hairy legs. But spiders are fascinating animals and they help us a lot by keeping bugs under control. Unlike insects, spiders always live by hunting, and insects make up most of their prey. Some spiders stalk their victims, but many ambush them or trap them in silken webs. Next time you see a spider, take a closer look. Lots of spidery eyes will be looking back at you.

IMPORTANT

Some spiders have a dangerous bite or tiny hairs that get into your skin. To be safe, never pick up a spider with bare hands.

Spider basics

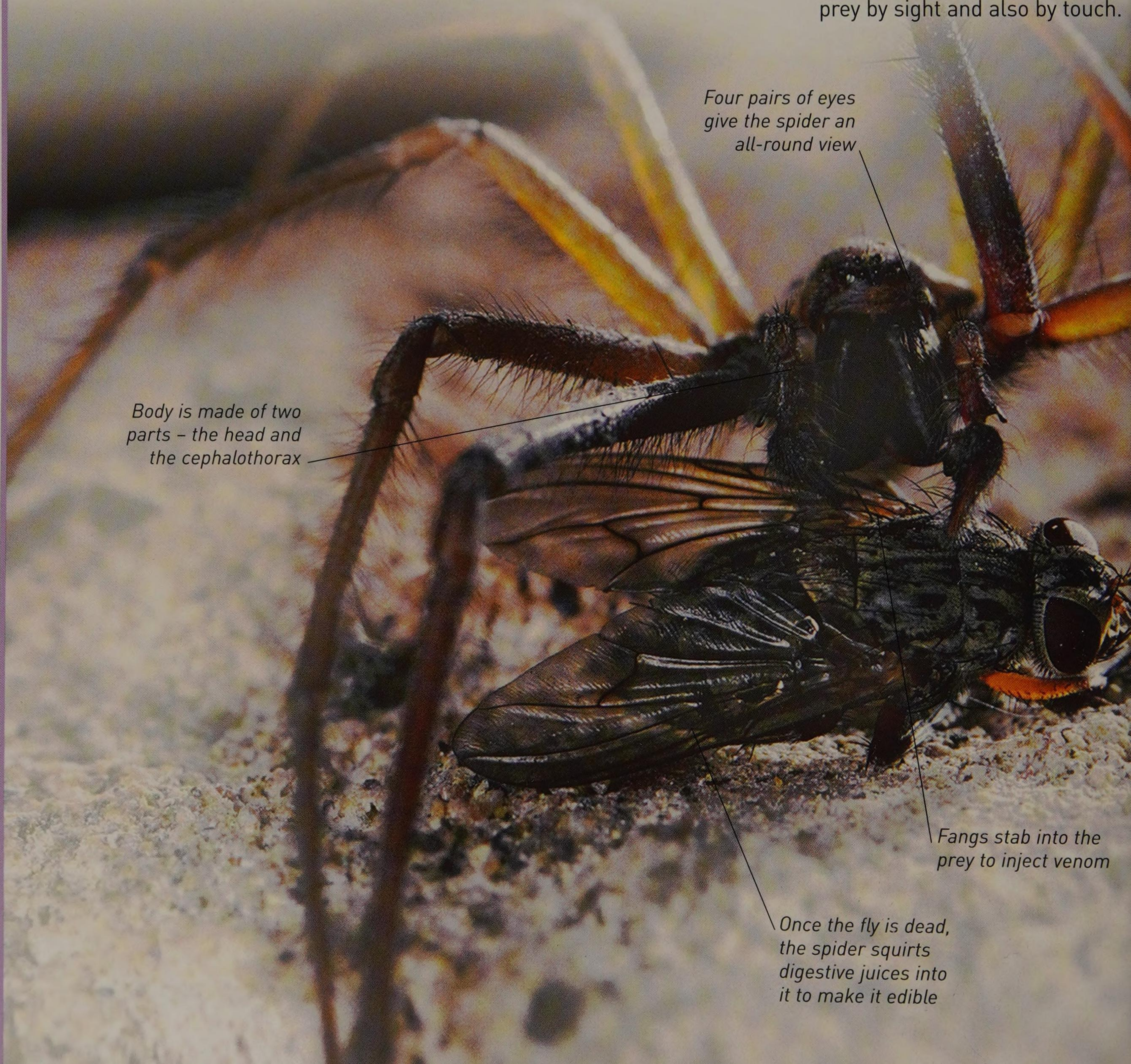
This male house spider has just caught a fly. Like all spiders, it has eight legs and a pair of poisonous fangs. Its mouth is tiny, so instead of chewing its food, it has to suck it up. House spiders have four pairs of eyes. They find their prey by sight and also by touch.

Four pairs of eyes give the spider an all-round view

Body is made of two parts – the head and the cephalothorax

Fangs stab into the prey to inject venom

Once the fly is dead, the spider squirts digestive juices into it to make it edible



HIDDEN SPIDERS

Spiders are easy to spot when they scuttle across the ground. But lots of spiders take care not to be seen. If you look carefully at bark and among leaves, you will often find spiders that are beautifully camouflaged. The world's biggest spiders hide in burrows and come out to feed at night.



Into the open ▲

At sunset, this tarantula comes out of its home in a tree hole to hunt.

Spider parade

There are more than 40,000 kinds of spider in the world, and they come in many shapes and sizes. Look out for these common kinds – they often live in gardens, backyards, or indoors.

Crab spider ►

These colourful spiders lurk among flowers and catch insects as they land to feed. Although they are only about 2 cm ($\frac{3}{4}$ in) long, their venom is powerful enough to kill bumblebees and butterflies.



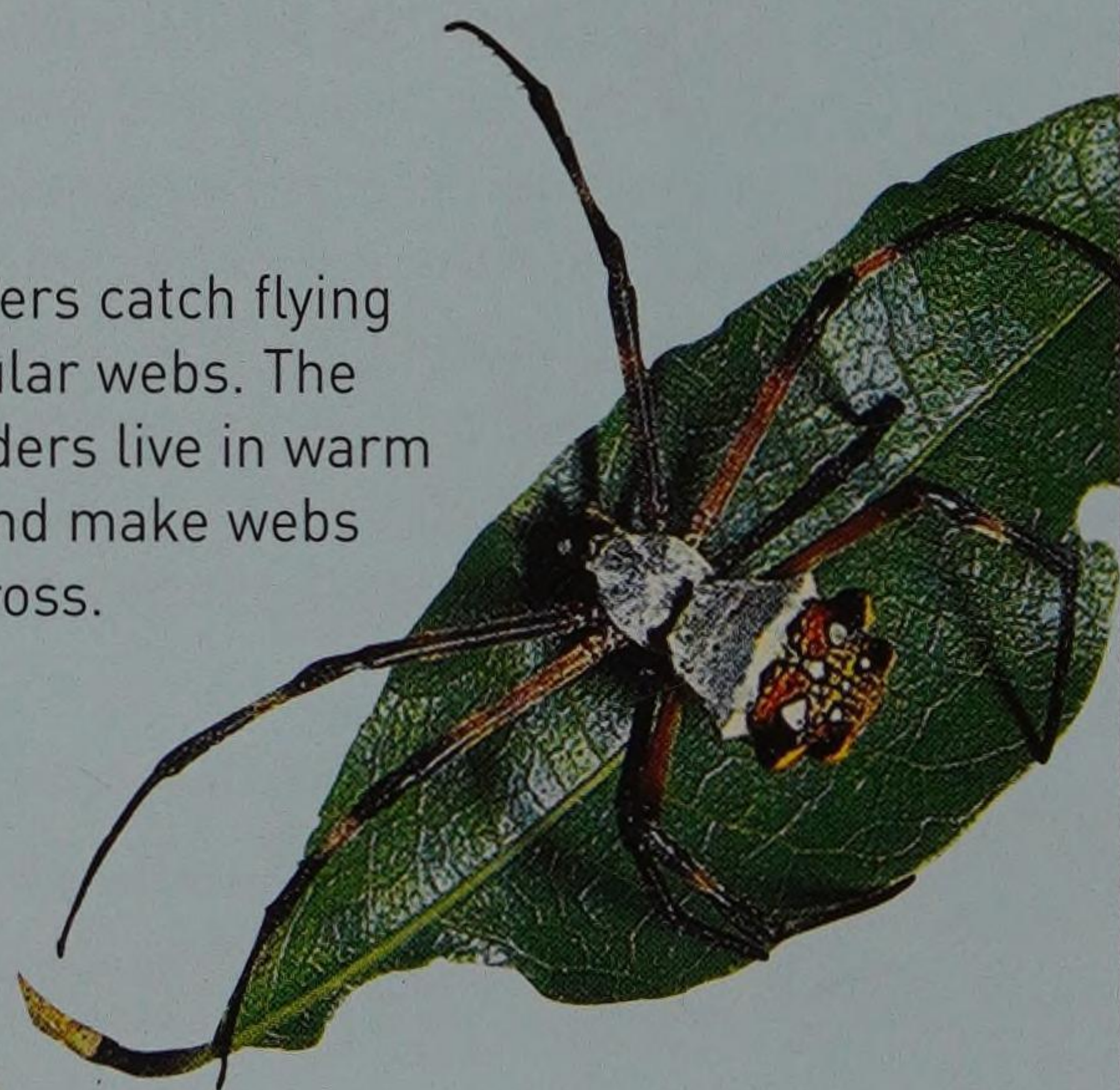
◄ Jumping spider

Jumping spiders have large front eyes. They hunt by day, watching for tiny animals and leaping on them. They often have stripy bodies and short legs.



Orb-web spider ►

These common spiders catch flying insects in their circular webs. The largest orb-web spiders live in warm parts of the world and make webs over 1 m ($3\frac{3}{4}$ ft) across.



◄ Grass spider

Grass spiders have long bodies and four pairs of small, forward-facing eyes. If they are threatened, they often stretch out along a twig or a blade of grass to hide.



Long legs covered with sensitive hairs that detect tiny vibrations from other animals

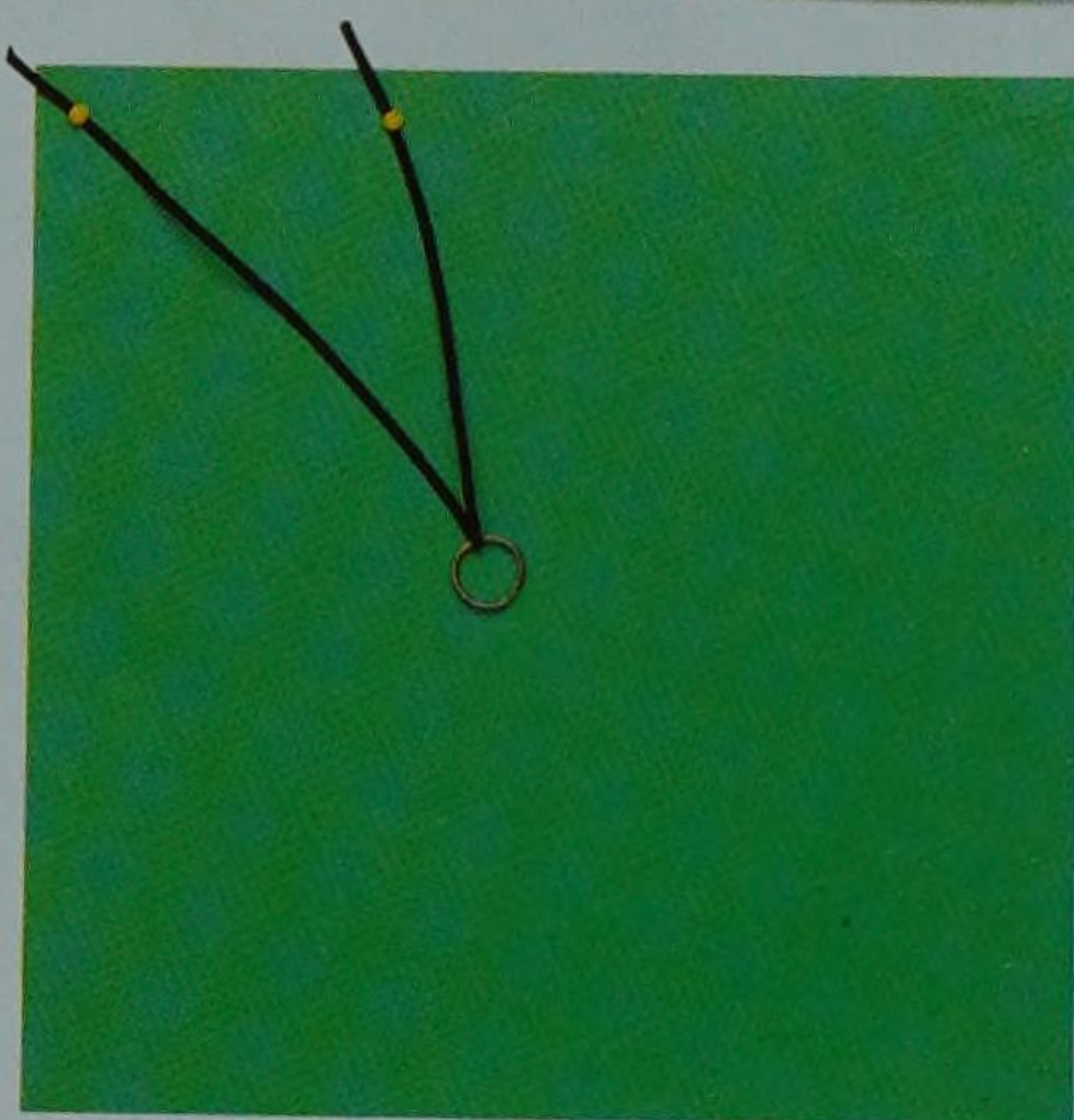
Spiders' legs end in small pads or claws

Web watch

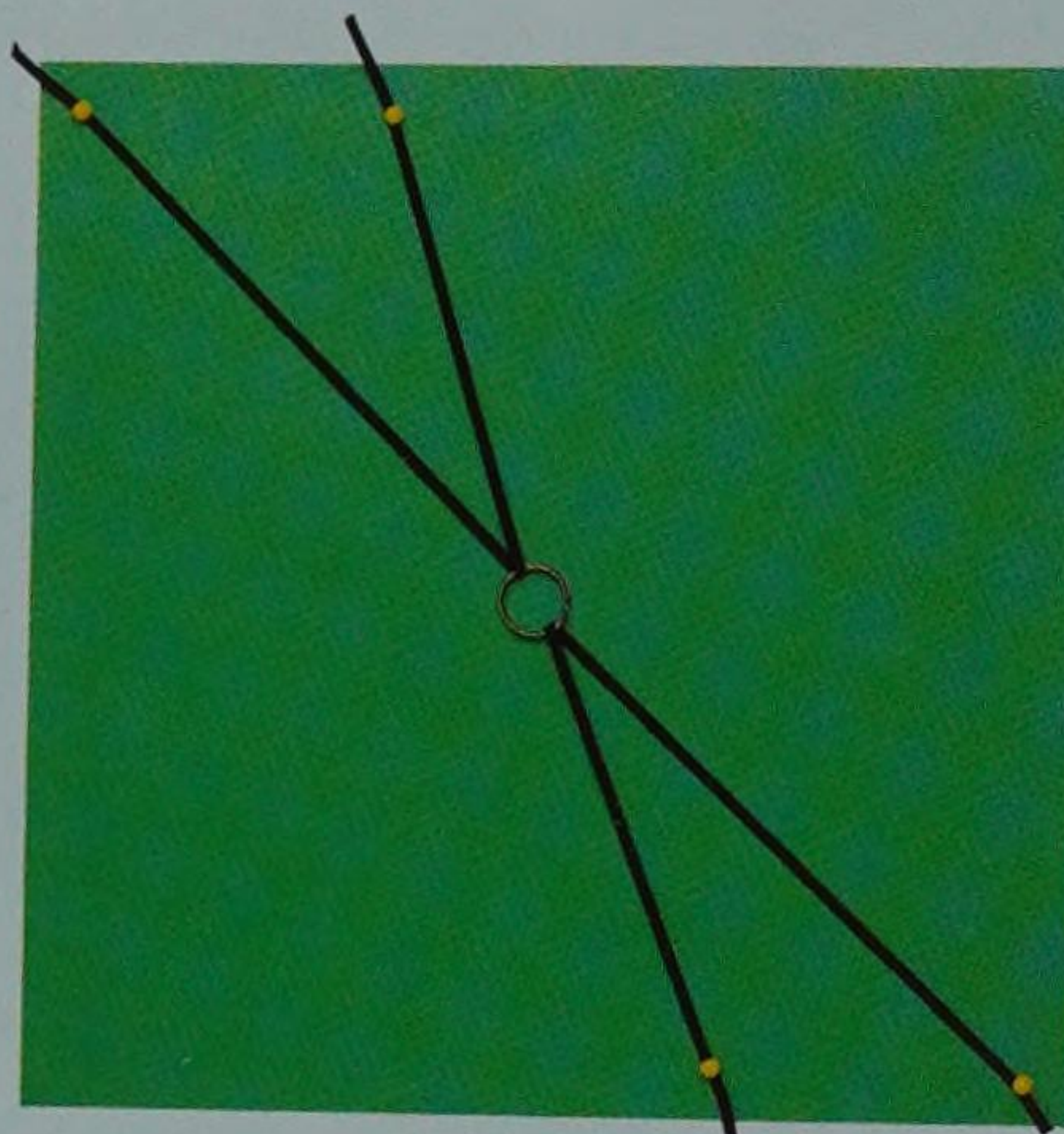
Orb-weaver spiders are some of the best builders in the animal world. Their webs are tough and efficient, thanks to the stretchiness of the silk and the way they are designed. One of the best ways to investigate webs is to make one yourself. If you use elastic, rather than string, your web will stay in shape just like the real thing.

WHAT YOU WILL NEED

- Wooden board 50 cm (19³/₄ in) square
- Coloured paper 60 cm (23¹/₂ in) square
- Scissors
- Sticky tape
- Simple ring, keyring, or narrow washer
- 4 m (13 ft) flat elastic braid, 5 mm (1/4 in) wide
- 12 coloured drawing pins or map pins
- Reel of fine elastic thread, at least 10 m (33 ft) long

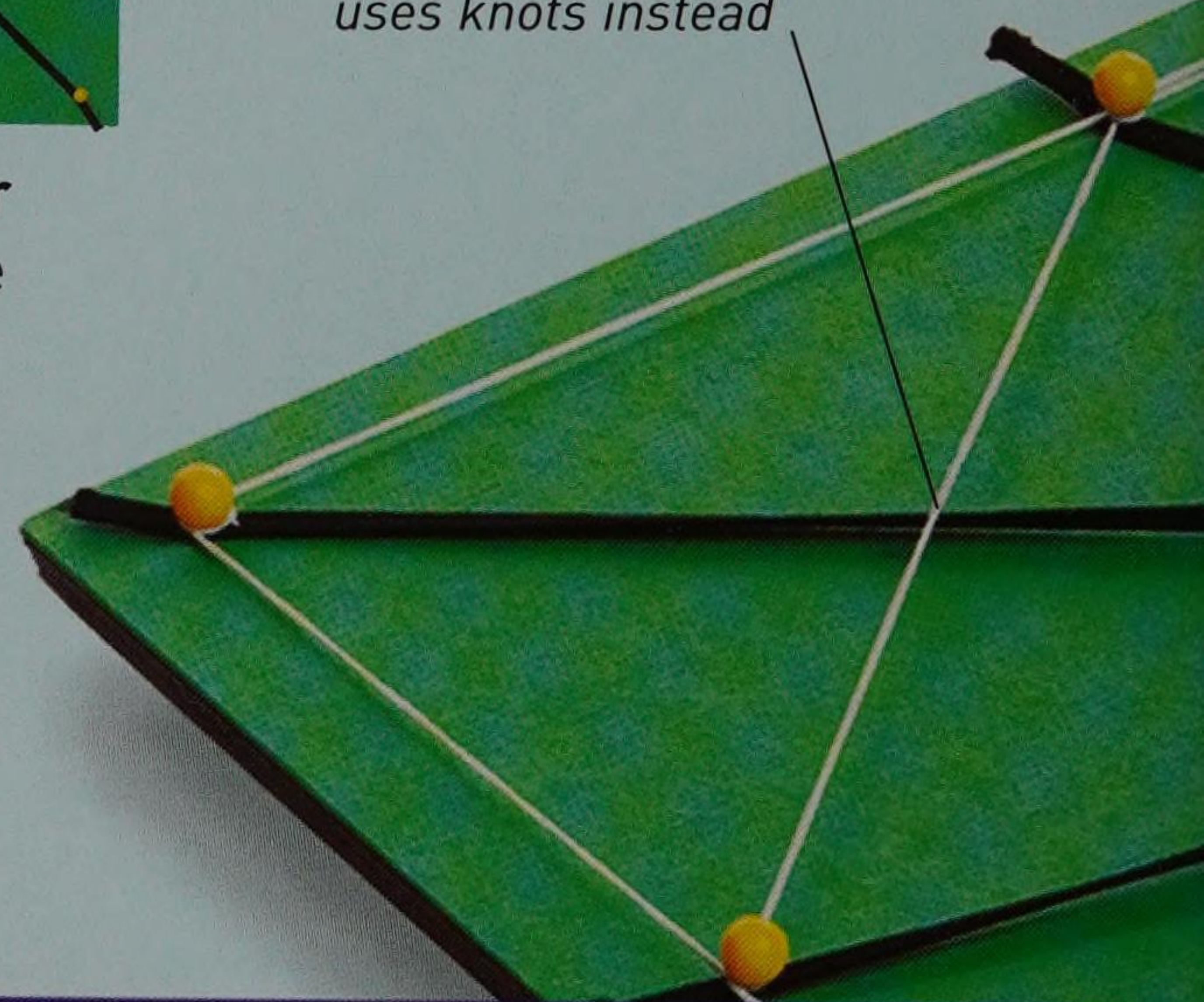


1 **Cover the board** with paper and put the washer in the middle. Pass a piece of braid through it and pin both ends to the edge of the board to make the first two spokes. Make sure the braid is pulled tight, then trim the loose ends.



2 **Make another pair** of spokes opposite the first, adjusting the braid so that it is tight and the washer is still in the middle. Then pin the braid in place and trim it as before.

Spiders glue the spiral to the spokes, but the model web uses knots instead



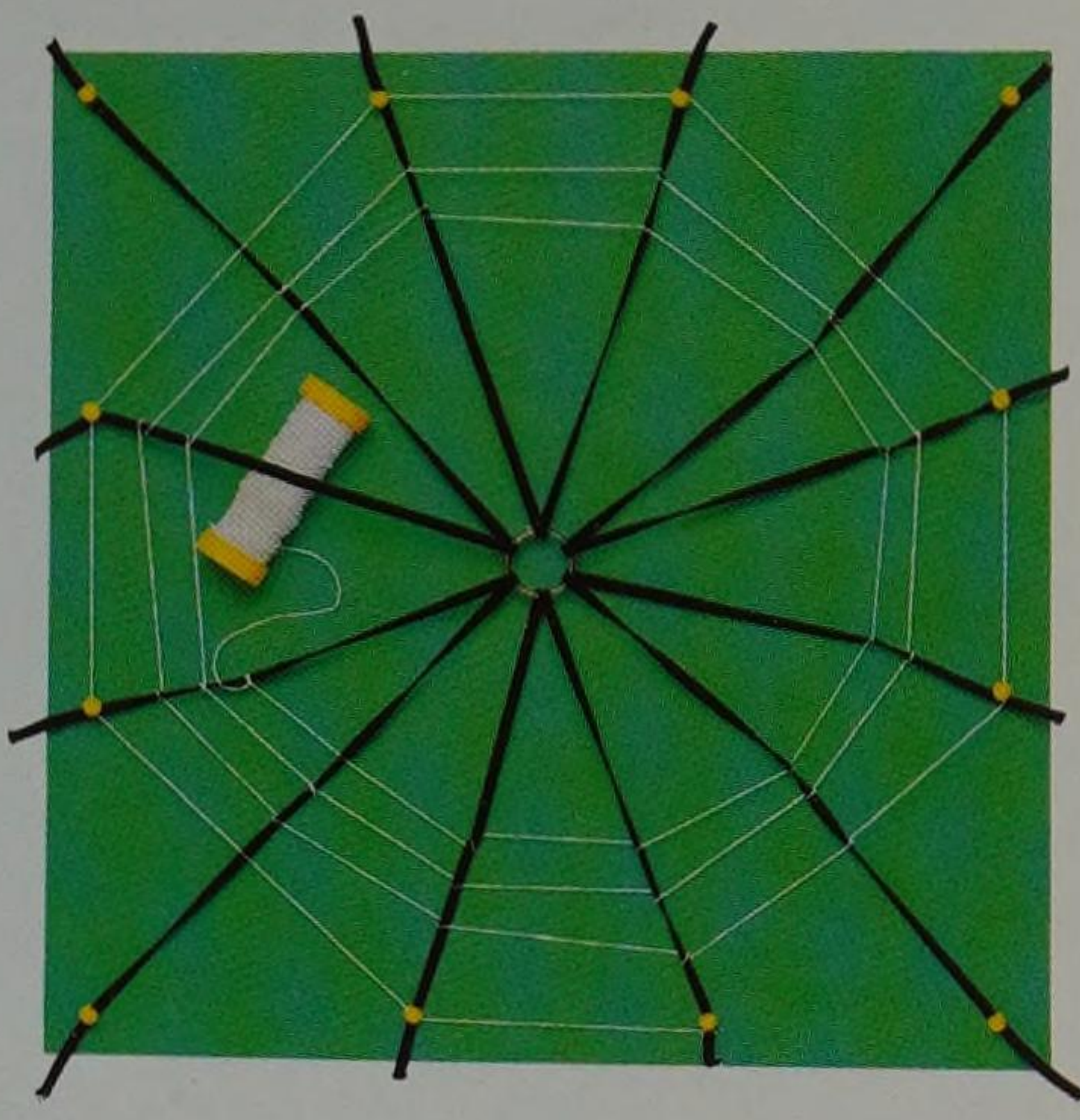
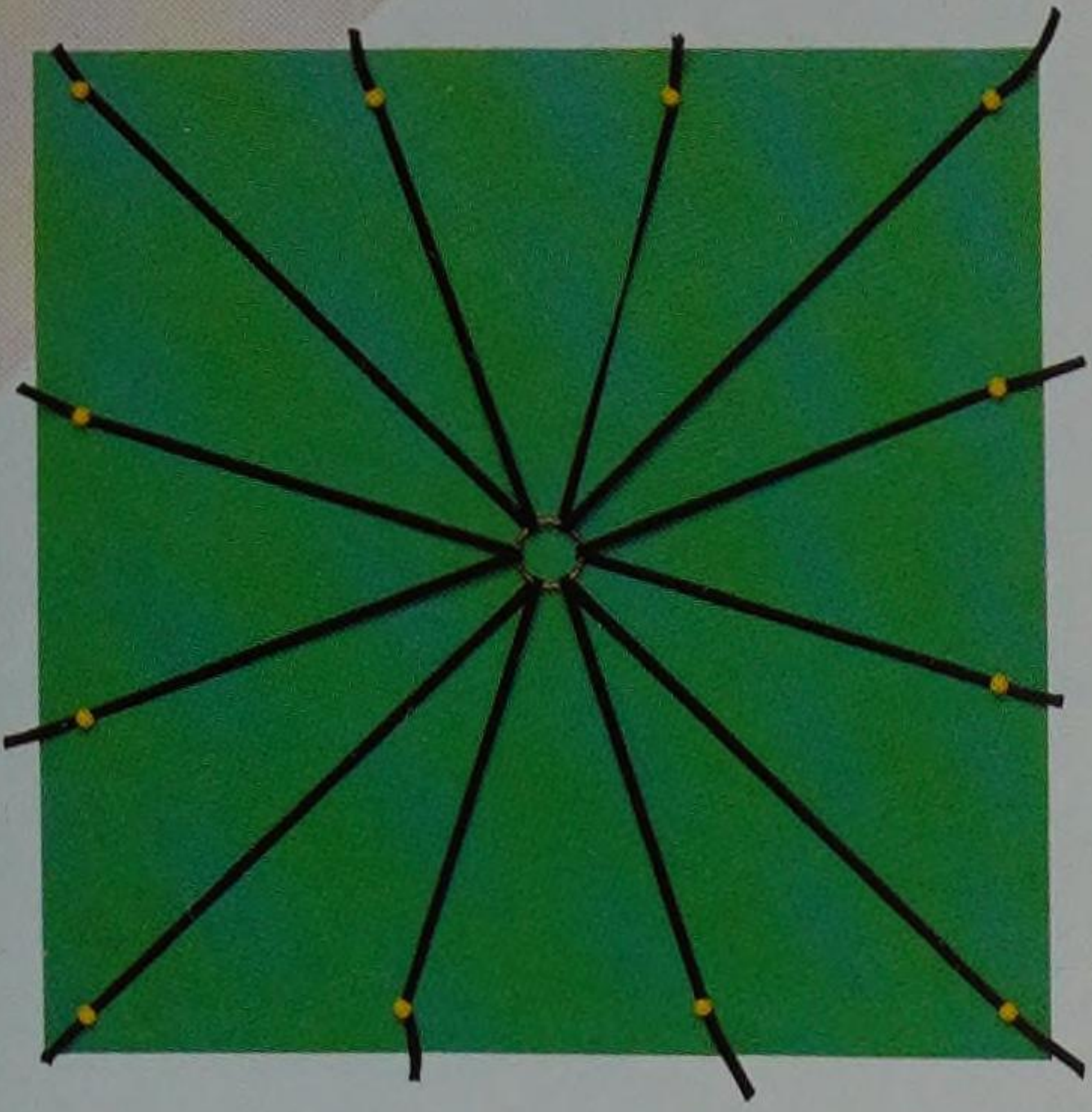
MAKING SILK

If you look at a spider with a magnifying glass, you will be able to see how it makes silk. The silk comes out of nozzles called spinnerets, like toothpaste squirting out of a tube. It hardens as it meets the air, turning into stretchy strands. Most spiders make dry silk to build the spokes of their webs and sticky silk to connect them together.

Starting out ►

This spider is producing strands of dry silk, which will make up the framework of its web.

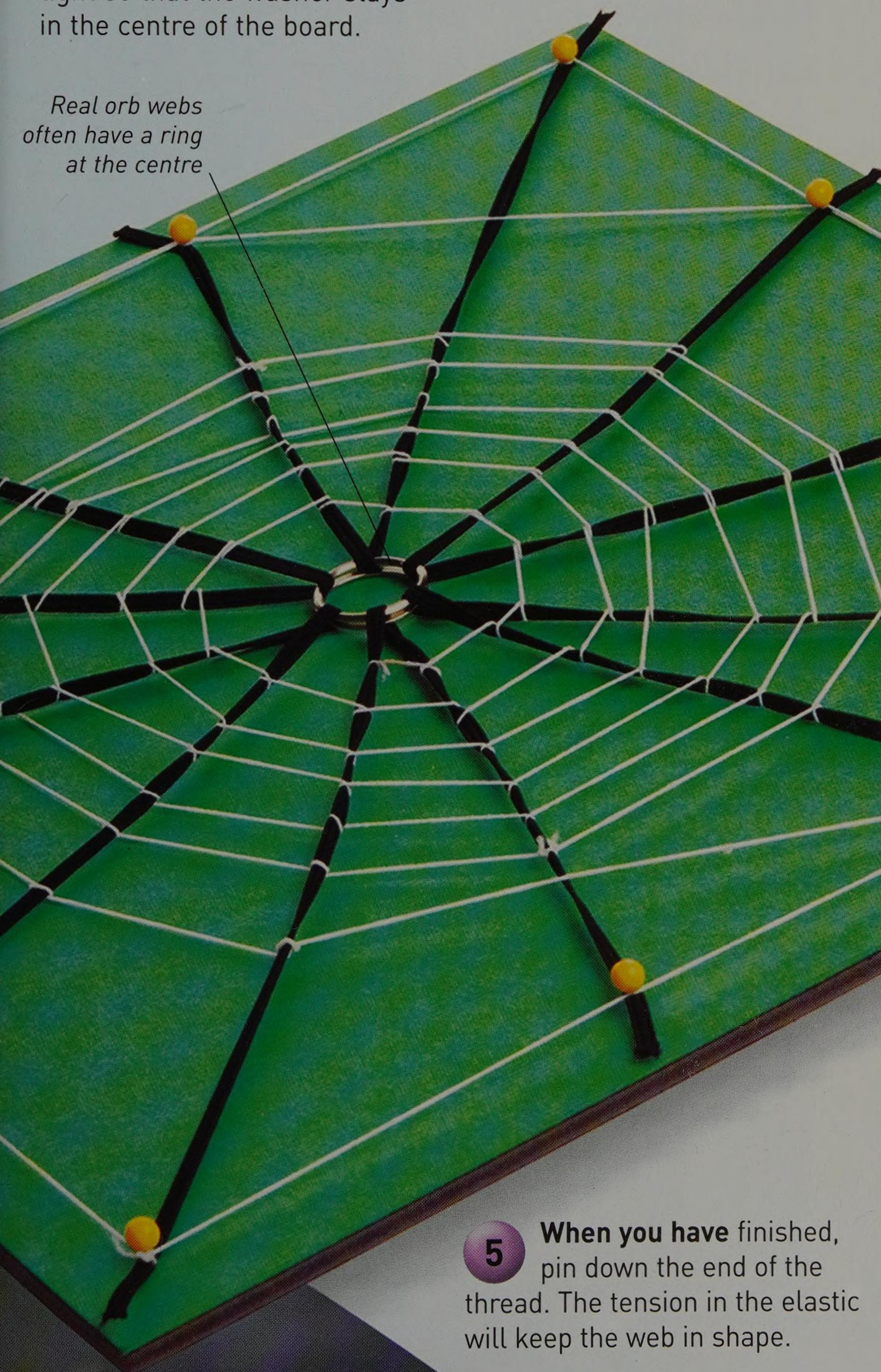




3 Working on alternate sides of the board, put the remaining spokes in place. Remember to keep the braid tight so that the washer stays in the centre of the board.

4 Starting at the centre, make a spiral with the elastic. Wind it around each spoke in turn and keep it taut.

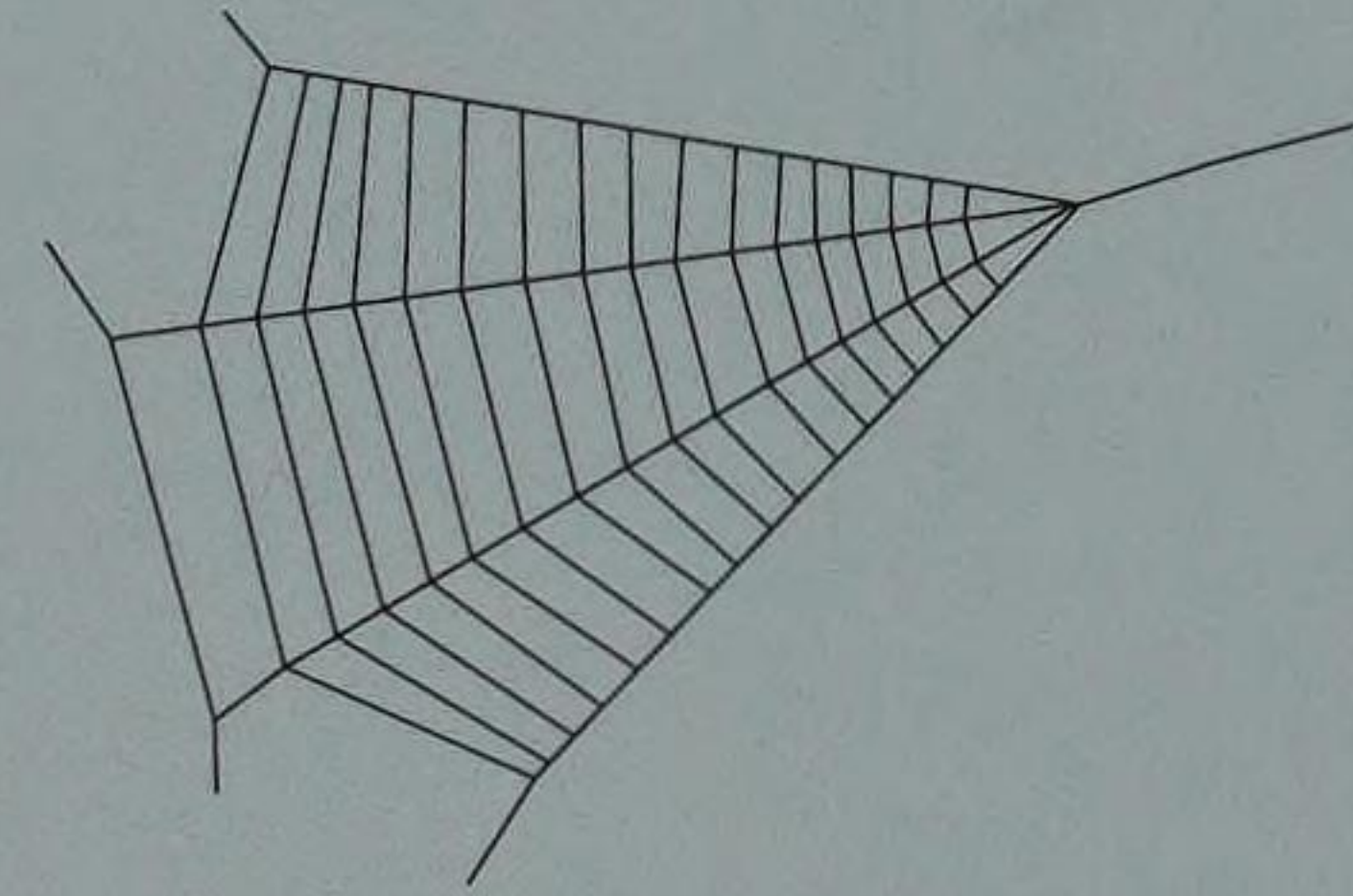
Real orb webs often have a ring at the centre



5 When you have finished, pin down the end of the thread. The tension in the elastic will keep the web in shape.

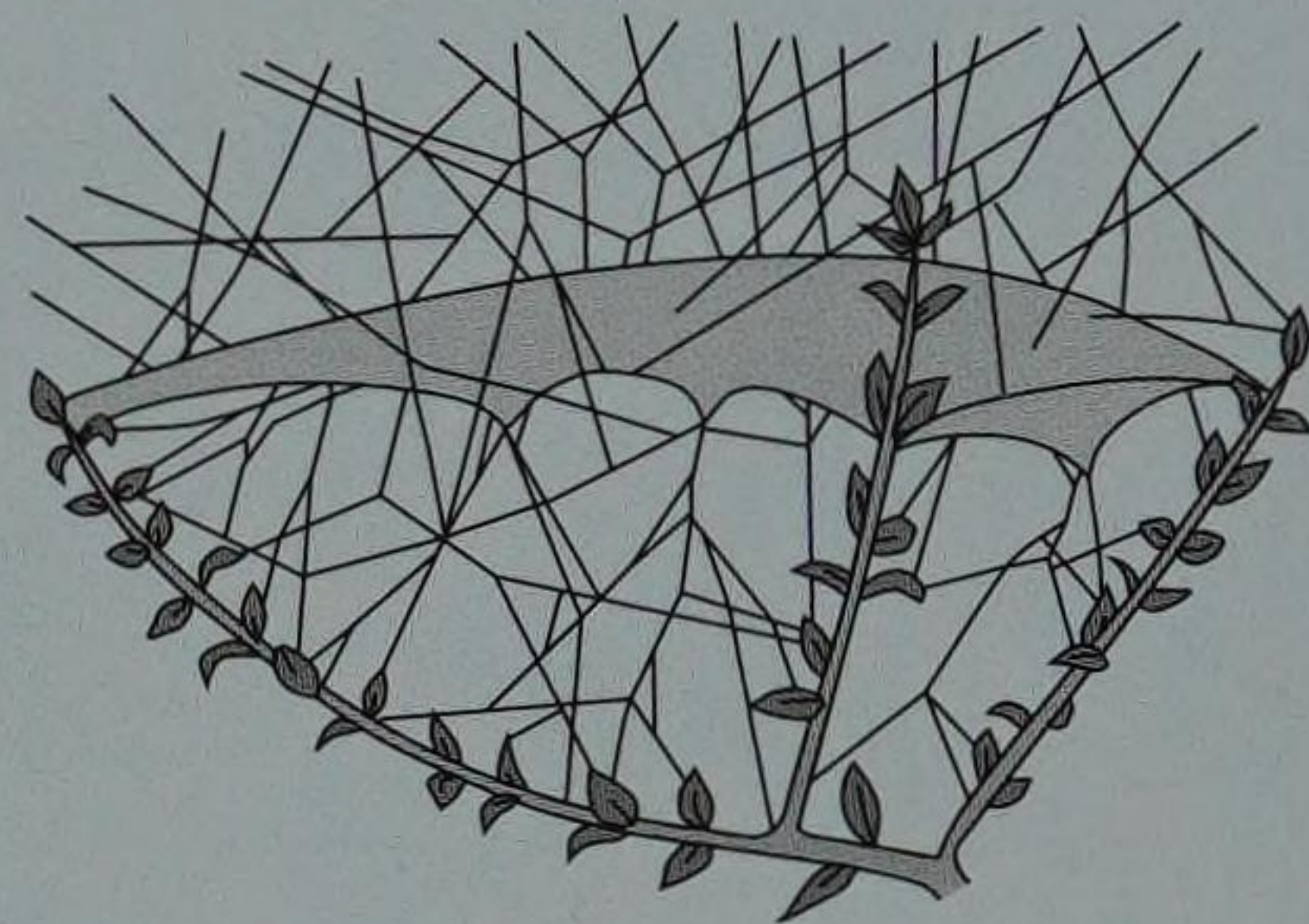
Web types

If you ask someone to draw a spider's web, they will probably draw an orb web. But spiders make many different kinds of web. See how many of these you can spot.



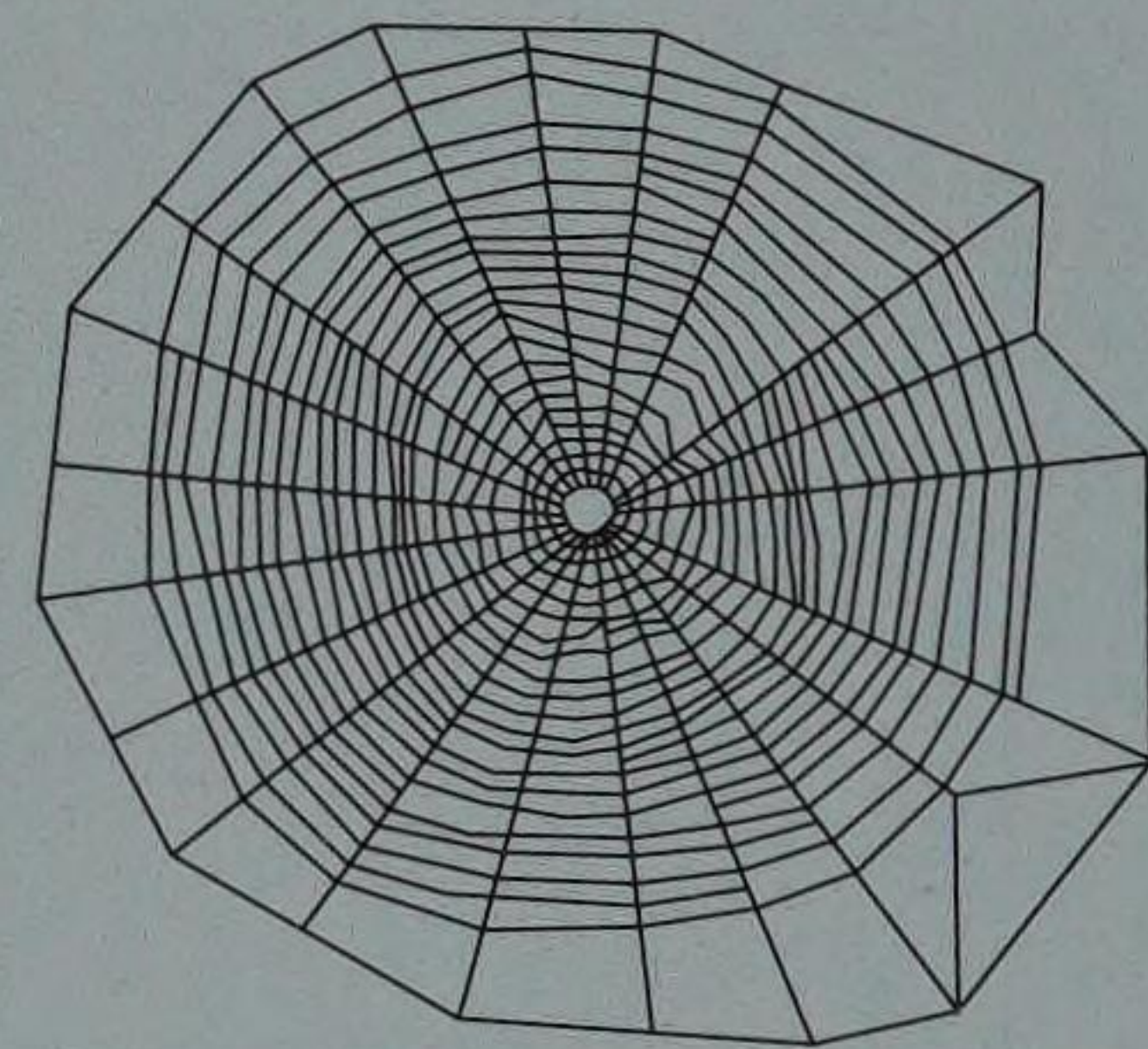
Triangular web ▲

Triangle-web spiders make webs with four spokes. They sit on a twig holding a line to keep the web taut.



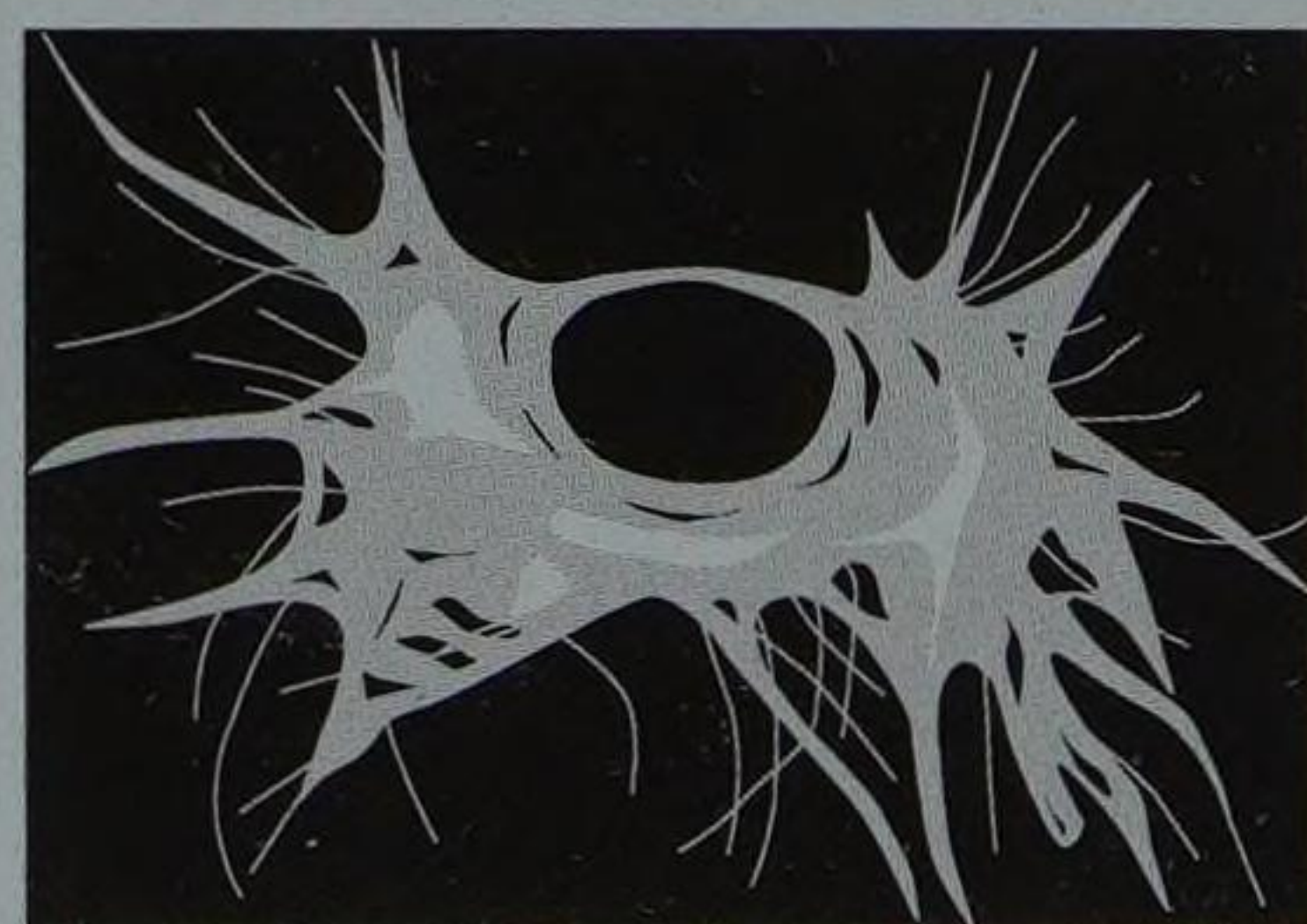
Hammock web ▲

Hammock-web spiders spin a silk sheet, to which they add a tangle of fine silk lines. Insects get caught in these lines.



Orb web ▲

Some orb-web spiders spin webs with a patch or zig-zag of silk at the centre, where they wait for their prey.



Funnel web ▲

Funnel-web spiders make webs that spread out like a funnel from their lair. These webs are often found in corners or between stones.

Good vibrations

Although they have lots of eyes, most spiders cannot see well. Instead, they rely on touch to tell when an insect has landed on their web. The struggling insect makes the web vibrate. The spider senses the vibrations and rushes across the web to grab its prey. With the help of a blade of grass – or better still a tuning fork – you can sometimes trick a spider into thinking it has caught a meal.

WHAT YOU WILL NEED

- Blade of grass or tuning fork



Be careful not to tear any webs.

HOW SPIDERS FEED

Spiders have tiny mouths so they cannot chew their prey. Instead, they squirt digestive juices into their victims to dissolve the soft parts. The spider then sucks up this juicy mixture, leaving a dried-out husk. Before they feed, many web-building spiders wrap up their prey in silk. Some leave the corpse on their web, but many snip it free and carry it back to their lair.

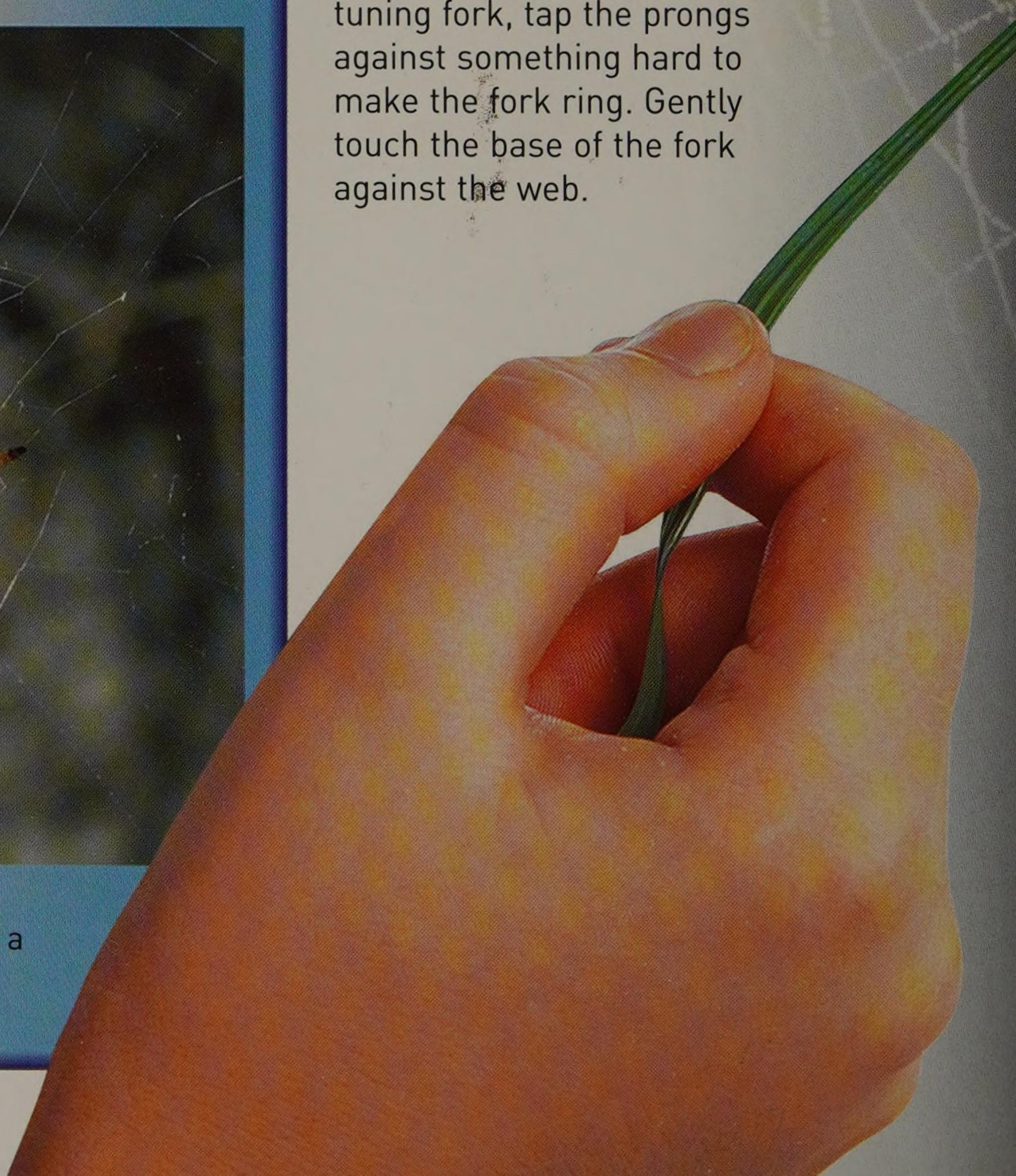


Packaged food ▲

This garden orb-web spider has caught a small insect and is wrapping it in silk.

Touchy moment

Pick a blade of grass and tap it on a spider's web so that the tip vibrates. If you vibrate it fast enough, the spider will mistake it for a buzzing insect and will rush across the web. The moment you stop tapping, the spider will stop too. To try this with a tuning fork, tap the prongs against something hard to make the fork ring. Gently touch the base of the fork against the web.





TRAPDOOR SPIDERS

In warm parts of the world, look out for silk triplines on the ground. These belong to trapdoor spiders, which live in burrows with camouflaged lids. Trapdoor spiders use these triplines to sense their prey. If an insect accidentally brushes against one of them, the spider flings open the lid of its burrow and runs out to catch its meal. If you spot a trapdoor, try lifting it with a twig. The spider will hide at the bottom of its burrow or make an emergency escape.

Opening time ►

This trapdoor spider has sensed movement and is rushing out to catch its prey.



Hanging by a thread

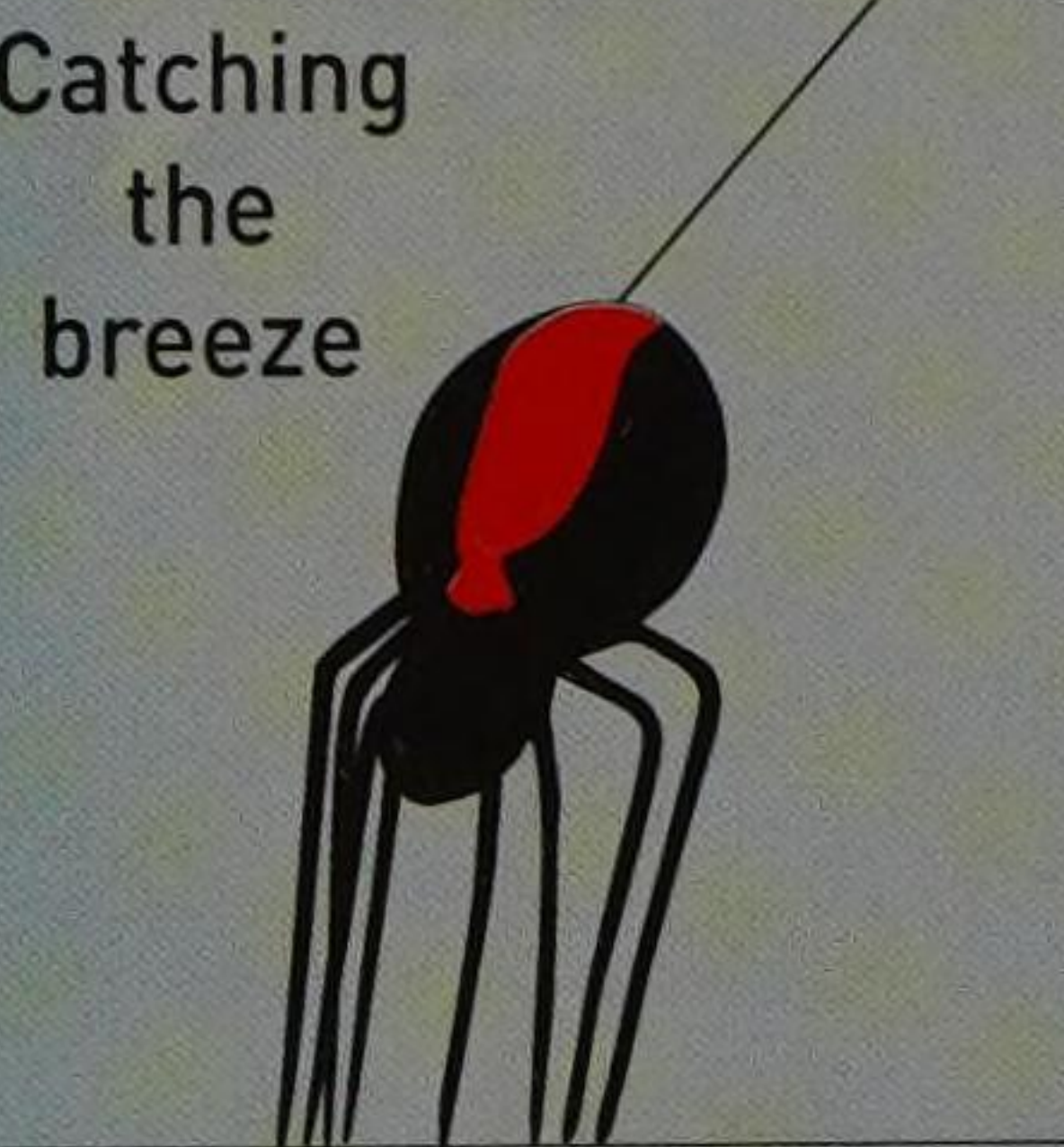
When spiders move about, they leave a line of silk behind them. It is called a dragline and it lets spiders drop safely through the air, or even glide away. A spider's dragline is often so fine that it is hard to see, but it is easily strong enough to support the spider's weight. If you persuade a spider to take a jump, you will be able to see its dragline in action. Unlike a reel of thread, it never gets tangled up and it never runs out.

UP AND AWAY

Releasing
silk



Catching
the
breeze



Floating
away



On warm days in summer and autumn, you may find small spiders on your clothes or skin. How do they get there? The answer is that they fly. Spiderlings let out a line of silk, and when the wind catches it they float away. When the Sun is low, watch out for their silk lines (gossamer) spread over the grass.

◀ Getting airborne

To take off, a young spider climbs to a high point, such as the tip of a blade of grass. It points its abdomen upwards and lets out a line of silk. If the breeze is strong enough, it catches the line and lifts the spider into the air.

WHAT YOU WILL NEED

- Jam jar
- Piece of card
- Spider
- Watercolour paintbrush

Tip the jar gently so that the spider isn't taken by surprise

- 1 Use the jam jar** and card to catch a small spider. Try looking on walls in gardens and in corners indoors.
- 2 Turn the jar** upright and give it a gentle shake to make the spider fall to the bottom. Then you can remove the card from the top of the jar.
- 3 Pick up** the brush. Hold the jar at shoulder height and gradually turn it on its side. Use the brush to edge the spider out of the jar.
- 4 The spider** will drop into the air, lowering itself on its dragline. It can stop at any point by shutting down its spinnerets, and can climb back up its dragline.

IMPORTANT

Do the dragline test outside if you do not want the spider to escape indoors. Don't touch the spider with your hands in case it bites you.

BOLAS SPIDERS

Instead of making webs, bolas spiders catch their prey with a single line of silk. A bolas spider hangs underneath a twig and lets out a short length of silk tipped with some blobs of glue. When a flying insect comes nearby, the spider whirls the line and then throws it at its target. If its aim is good, the glue sticks to the insect and the spider pulls it in.



Getting ready ►

This bolas spider is waiting for an insect to come near. Bolas spiders have good eyesight, and hunt mainly at night.

HANDY TIP

Small spiders are best for this experiment because they often drop through the air on draglines.



Spiders without webs

All spiders make silk, but only some of them use webs to catch food. Many other kinds hunt by lurking in flowers or by searching out their prey. These roaming hunters include spiders that get stuck in baths, as well as huge tropical tarantulas that feed on lizards and even birds. Some of these spiders are true wanderers, but most build themselves a lair. When they have finished hunting, they go home and hide.

SPIDERS IN THE BATH



◀ Spider rescue

If you find a spider trapped in the bath, don't wash it away. Instead, use a jam jar and a piece of card to catch it and put it outside. Put the jar over the spider, then slide the card underneath. Turn the jar upright, then take away the card and replace it with the jam jar's lid.

Bathrooms are great places for spotting spiders, which often seem to lurk in baths and basins, giving people a nasty shock. But how do they get there, and why? Despite what you may have heard, spiders definitely don't come up the plug-hole. They fall in while they are looking for food or for a mate. Once they are in, they are trapped because their feet cannot get a grip on a bath's shiny sides.

Spider's bright colour may be easy for a human to spot, but it is not so easy for an insect to see

Lurking in flowers

If you see a bee or a butterfly that seems stuck to a flower, take a closer look. It's very likely that it has been caught by a crab spider. Crab spiders lurk in flowers with their front legs held out like a crab's claws. If an insect lands, the spider snaps shut its legs to grab its prey.





Ground hunters

Many spiders hunt on the ground. This wolf spider is a daytime hunter and it uses speed to catch its prey. It runs over the soil and up small plants, catching anything that comes its way.

A tarantula's feet are covered with short hairs, which give the spider a good sense of touch

Hunting at night

The world's biggest spiders are tarantulas. They are ground-based hunters, although they sometimes climb trees. Unlike wolf spiders, they creep about after dark, using their legs to feel for food.

Downward-pointing fangs pin the spider's prey to the ground when it attacks

LOOK HERE!



Jumping spiders are small, perky creatures, which often walk over fences and walls. They have good eyesight and they jump like tiny acrobats, landing on their prey. If you find a jumping spider on a wall or paving stone, hold an upright pencil a few centimetres away. Move the pencil in a circle around the spider. The spider will turn around to watch the pencil moving and may even look up to glance at you.

◀ Double take

Unlike other spiders, jumping spiders are not afraid of people. Using their big front eyes, they will have a good look at anything you put in their way.

Family life

Compared to insects, spiders are careful parents. Female spiders often guard their eggs and some of them even carry their young on their backs. The spiderlings stay aboard their mother for several days until they are ready to start life on their own. But before any of this can happen, parent spiders have to get together and mate. For the male spider, mating can be a dangerous business. If he moves too fast or gives off the wrong signals, the female may attack him and turn him into a meal.



Him or her?

In the spider world, females are often much bigger than males. Here, a male black widow looks tiny compared to his vastly bigger mate. If you see a small spider approaching a much larger one on a web, it may well be a courting couple.

Male waves his palps up and down in a set sequence, while creeping towards the female

Careful approach

This male wolf spider is signalling to a female so that he can approach her and safely mate. He does this by waving his palps, which look like a pair of arms. Web-building spiders use a different system. The male signals by giving the female's web some sharp tugs.

Precious packages

Female spiders wrap their eggs inside a cocoon, or sac made of silk. Some bury their egg sacs underground, but many fasten them to plants or hide them in crevices indoors. Wolf spiders carry their egg sacs with them as they move about.

Egg sac is slung underneath the mother's body or attached to her spinnerets



SCATTER

When garden spiders hatch, they have to look after themselves. They cluster together in a ball on a special nursery web. If you spot one, gently tap it with a pencil. The ball will seem to explode as the spiderlings scatter. They will soon come back together, and the ball will reappear. This scattering trick helps to protect the spiderlings from birds.

Run for it ►

These spiderlings are scattering in all directions after being touched.



All aboard

When wolf spiders hatch, they climb on to their mother straight away and cluster around her back. She carries them wherever she goes. The spiderlings do not feed, but they stay on her back until they are ready to shed their skins. Once they have done that, they wander off to start hunting food.

Spiderlings link legs to form a living jacket around the female's body, keeping well clear of her legs



WHAT YOU WILL NEED

- Tray with a raised edge
- White paper or kitchen towel
- Anglepoise lamp
- Plastic bag
- Trowel
- Magnifying glass

Life in leaf litter

When leaves fall to the ground, they turn into a crumbly compost called leaf litter. This underfoot world is a great place for bug hunting because it's full of mini-insects and creepy crawlies. Leaf litter animals live in a world that is damp and dark and they normally stay hidden beneath the surface. But if you collect some leaf litter and shine a bright light on it, they will scuttle for cover, making them easy to see.

Fallen leaves provide food for many kinds of leaf litter animals

Dead remains are eaten by beetles and other scavengers

MINI SCORPIONS

Pseudoscorpions are some of the most common animals in leaf litter. However, they are so tiny that you need really sharp eyes to spot them. These bugs look just like tiny scorpions, but the good news is they don't have stings. Pseudoscorpions use their pincers to catch other animals. Their pincers also come in handy for hitching a lift aboard insects – an easy way of getting around.

Predator with pincers ►

Pseudoscorpions have slender pincers, pear-shaped bodies, and eight legs. Most are less than 3 mm ($\frac{1}{8}$ in) long.



1 **Collect some leaf litter** with the trowel and put it in a plastic bag. Get plenty of damp leaves because the dry ones on top contain far fewer animals.

2 **Back home**, cover the tray with clean white paper. Put a handful of leaf litter in the middle of the tray and spread it so it forms a thin layer.

3 **Position the lamp** about 30 cm (12 in) above the tray and turn it on. The bright light and warmth will make animals move out of the litter. Once they are on the paper you can look at them closely with a magnifying glass.

4 **When you have finished** looking, take the tray outside and scatter the leaf litter and bugs in a shady place.

Fungi and bacteria help to break down the leaves, turning them into small fragments

Leaf litter critters

All kinds of bugs live in leaf litter. Some are vegetarians that feed on rotting leaves. Others are hunters that wriggle or creep through the leaf litter, finding their prey by touch. See how many of these bugs you can find.

Springtail ▶

These tiny animals have a "spring" under their bodies. They use it to flick themselves away from danger.



Rove beetle ▶

Beetles are common insects in leaf litter. Rove beetles hunt prey and also scavenge dead remains.

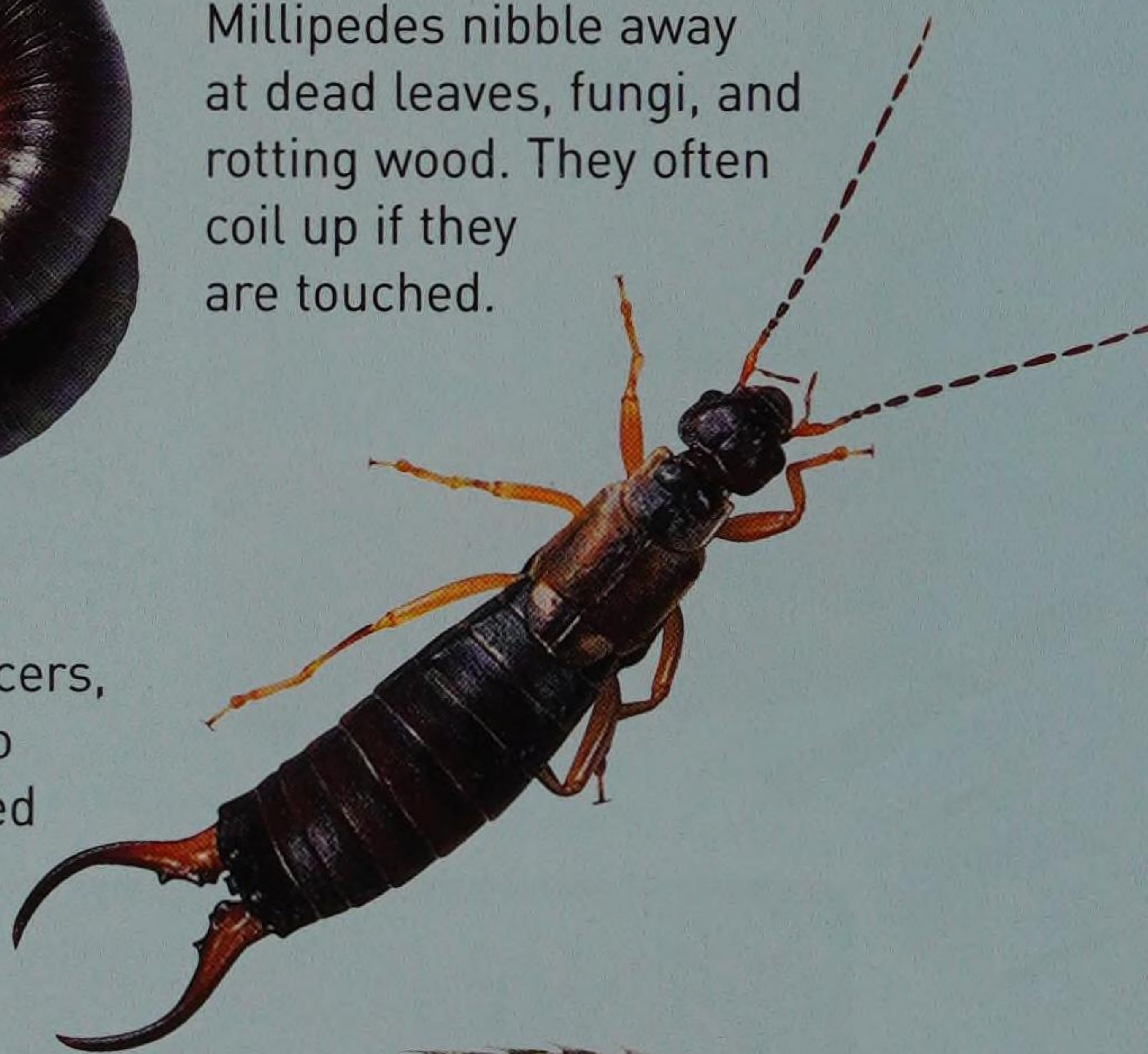


◀ Millipede

Millipedes nibble away at dead leaves, fungi, and rotting wood. They often coil up if they are touched.

Earwig ▶

With their long pincers, earwigs are easy to recognize. They feed on leaves and other insects.



Woodlouse ▶

Woodlice eat decaying leaves and fragments of rotting wood. Unlike insects, they have to stay damp to survive.



◀ Centipede

Unlike millipedes, centipedes have flat bodies. They can squeeze into tight spaces to hide or to search for their prey.

WHAT YOU WILL NEED

- Two empty fruit juice cartons
- Marker pen
- Scissors
- Stapler and staples
- Strong tape
- Piece of thin cardboard to make the lid
- Paper towels
- Cottonwool balls
- Water
- Woodlice and a spider

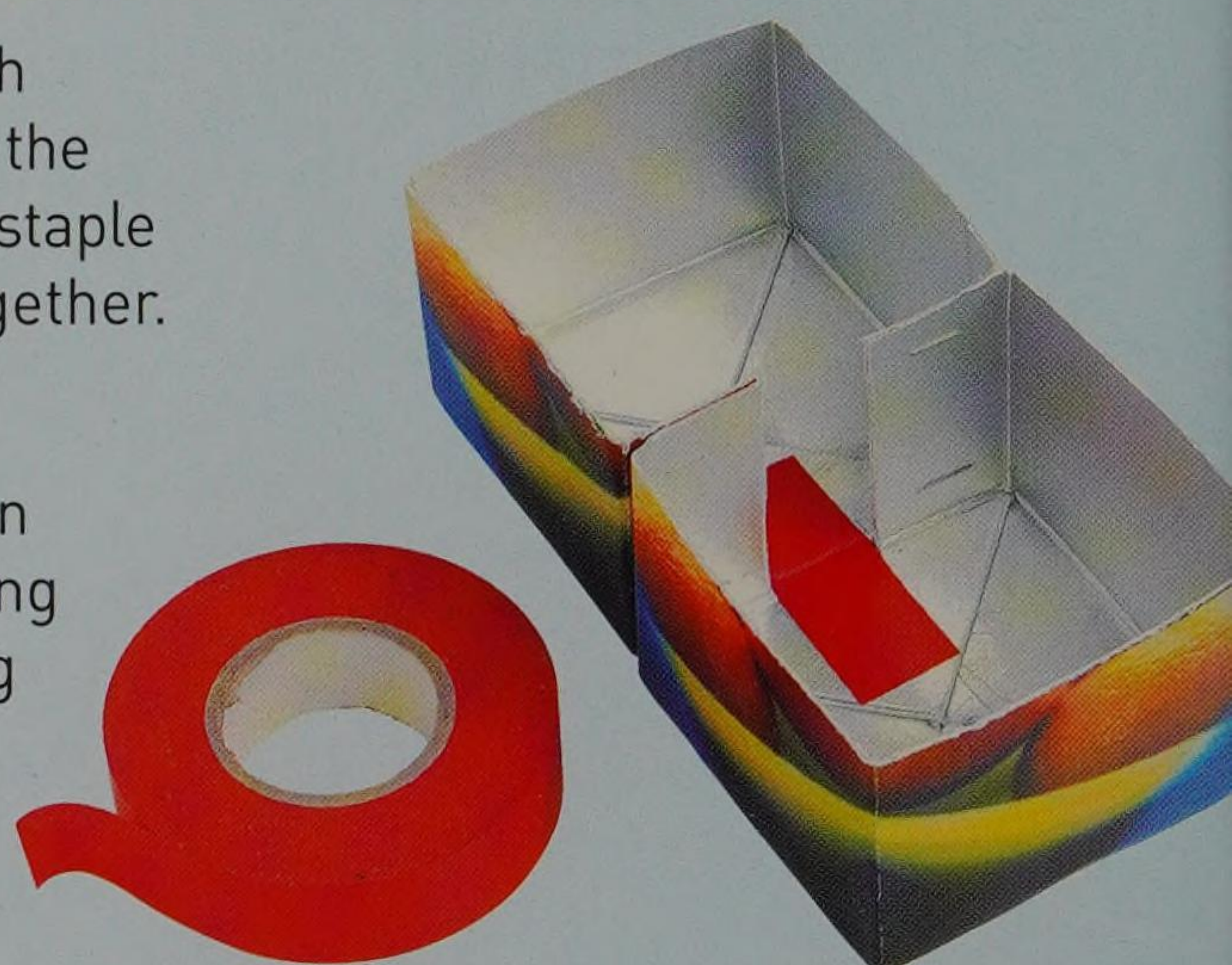
Decisions, decisions

If you make a choice chamber, you can see what conditions attract bugs and what they avoid. The chamber has two rooms connected by a narrow slit. You can adjust the conditions in each room (for example, by making one darker than the other) and leave the bugs to decide which they prefer. Woodlice are good animals for this test. Their brains are small, but they know what suits them best. You can also try repeating the activity using a spider.



1 Draw a line around each carton, 5 cm (2 in) from the base. Cut along the lines and staple the bottoms of the cartons together.

2 Cut an opening between the two cartons, reaching down to the base. The opening should be no more than 1 cm (1/2 in) wide. Seal the gap with a strip of tape.



BRAINY BUGS

Some bugs can behave in surprisingly clever ways. Digger wasps, for example, are very good at finding their burrows. They do it by remembering every detail of the ground nearby. These wasps have another, even more impressive trick. When they make a burrow, they often pack down the entrance with a tiny stone. Apart from mammals and birds, very few animals use tools of any kind. For a tiny insect, it is a remarkable skill.



Homing in ▲

Digger wasps nest on the ground in open, sandy soil. They need an exceptional memory to find their way back to their nest.

- 3** Cut a piece of cardboard to make a lid for one side. Attach it to the base with tape. Place a piece of paper towel in both sides and put some damp cottonwool balls in the side with the lid.

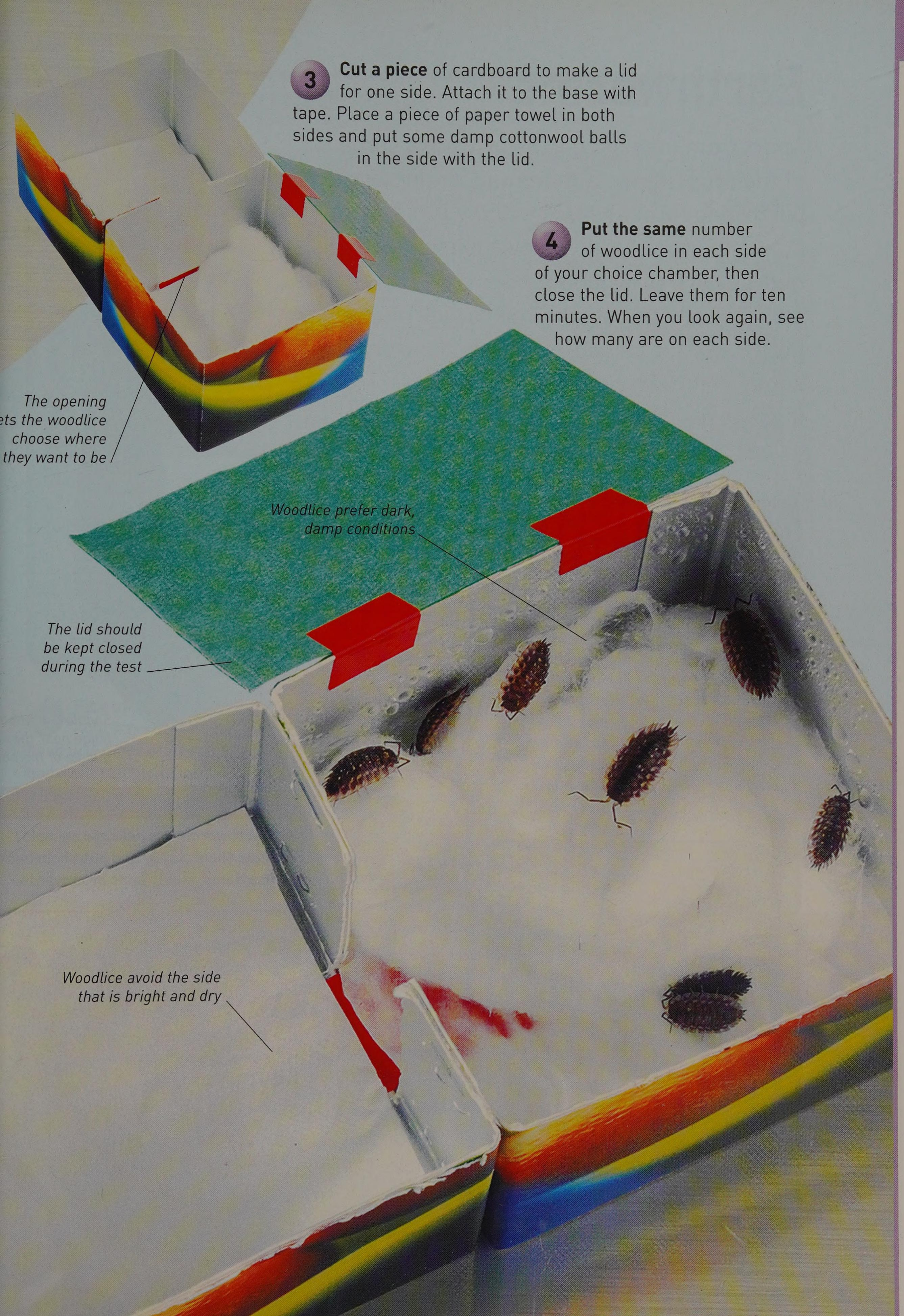
- 4** Put the same number of woodlice in each side of your choice chamber, then close the lid. Leave them for ten minutes. When you look again, see how many are on each side.

The opening lets the woodlice choose where they want to be

Woodlice prefer dark, damp conditions

The lid should be kept closed during the test

Woodlice avoid the side that is bright and dry



Earthworms

Apart from insects, earthworms are some of the most important animals in the world. By burrowing through the soil, they mix it up and help plants to grow. Earthworms look soft and squishy, but they are very good at tunnelling through the soil. To find out how they do it, pick one up and hold it in your closed-up hand. The worm will squeeze its way between your fingers, just as it squeezes through soil tunnels underground.

AMOROUS EARTHWORMS

Earthworms spend almost all their lives underground. The one time they stay on the surface is in late spring and early summer, when they are searching for a mate. They usually come out on warm, damp nights. If you want to see them, take a torch covered with a piece of red plastic, because worms react less to red light. Tread carefully, because they can sense vibrations and quickly disappear underground.



Earthworm embrace ▲

When earthworms mate, they lie side by side and cover themselves in sticky mucus.

WHAT YOU WILL NEED

- One common earthworm

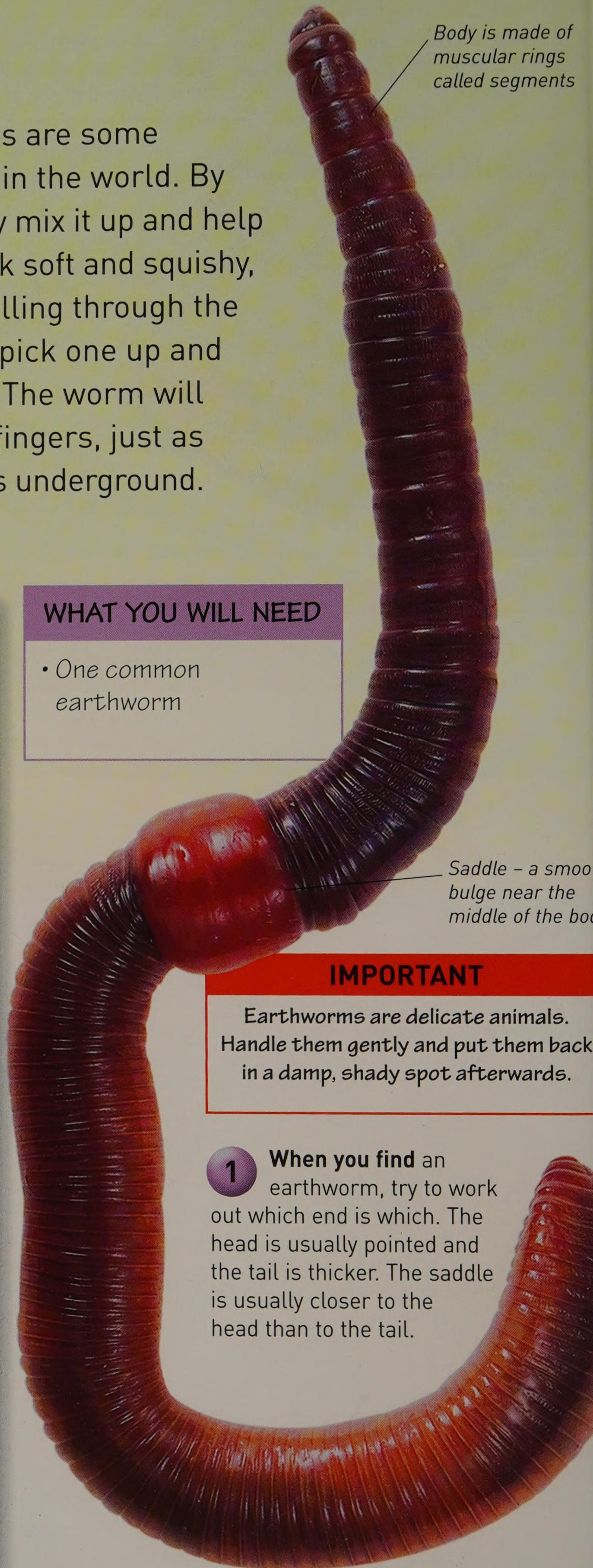
Body is made of muscular rings called segments

Saddle – a smooth bulge near the middle of the body

IMPORTANT

Earthworms are delicate animals. Handle them gently and put them back in a damp, shady spot afterwards.

- 1 When you find an earthworm, try to work out which end is which. The head is usually pointed and the tail is thicker. The saddle is usually closer to the head than to the tail.



EMERGENCY ESCAPE

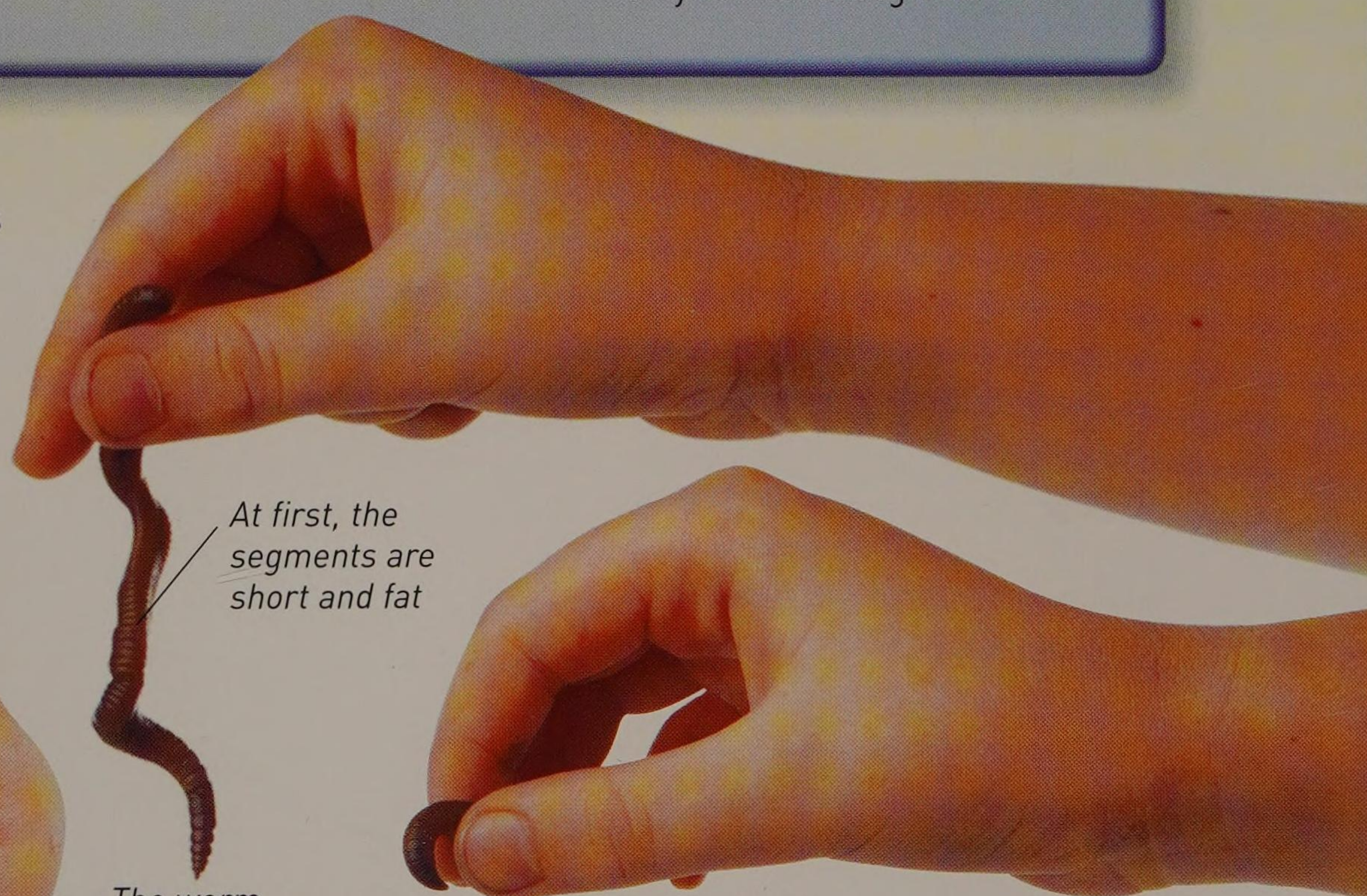


When earthworms are on or near the surface, they are at risk from hungry birds. To avoid being eaten, they have to be alert. They do not have proper eyes, so they cannot see danger. Instead, they rely on their sense of touch. An earthworm's skin is full of sensitive nerves. If a bird touches a worm's tail, the worm immediately contracts its body. With luck, it gets underground before the bird can pull it out.

Earthworm breakfast ▲

This thrush has caught an earthworm and is about to swallow its meal. Birds find earthworms partly by sight, and also by listening for the faint sounds they make as they tunnel through the soil.

2 **Pick up** the worm and hold it gently by its tail. Its head will move around and its body will start to lengthen as it tries to reach the ground.



At first, the segments are short and fat

The worm pushes its way through any gaps

4 **Finally, put** the worm in your hand and gently close your fingers. It will try to squeeze out. You may be surprised by its strength.

3 **Allow the worm** to relax its body segments. It can double or even triple its length in this way. Worms stretch like this when they burrow and when they crawl over the ground.

The segments relax, becoming longer and thinner

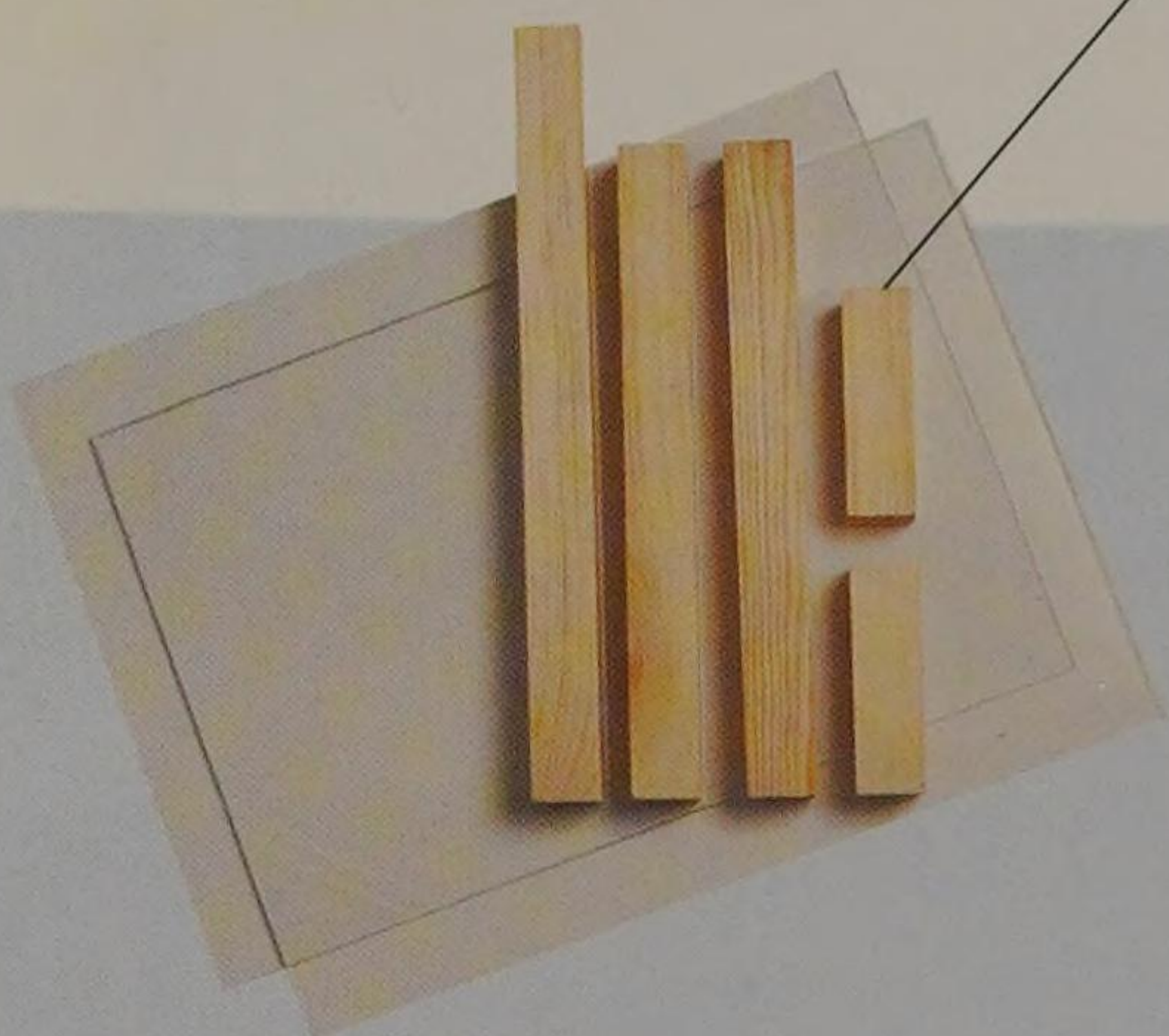
Building a wormery

Earthworms are normally hidden away, so it's difficult to find out how they live. But if you make a wormery, you can peer into their private world. The wormery shown here contains a narrow slice of soil, which makes the worms easy to see. If you build up the soil in contrasting layers, you will be able to watch how the worms mix it up and drag dead leaves underground. As they tunnel, they let air into the soil and help rainwater to drain away.

WHAT YOU WILL NEED

- Piece of wood 2.5 cm (1 in) x 2.5 cm (1 in) cut into:
two 25 cm (10 in) pieces
one 30 cm (1 1³/₄ in) piece
two 6 cm (2 1⁴/₄ in) pieces
- Saw and drill
- Two sheets of hard, clear plastic 25 cm (10 in) x 35 cm (13 3⁴/₄ in)
- Screwdriver and screws
- Local soils and sand
- Dead leaves

Ask an adult to help you cut the wood and plastic to size and drill the holes



Ask an adult to drill the holes and cut the plastic.



Don't leave any gaps or your wormery will leak

1 Cut the pieces of wood to size. Use the drill to make three equally spaced holes along both short sides of each sheet of plastic and three holes along one of the long sides of each sheet.

2 Use these holes to screw the plastic sheets on to the three pieces of wood that make up the frame. Then screw the two smallest pieces of wood to the base of the frame to make the feet.



Don't pack down the soil, leave it loose

WORMCASTS

In spring, the ground is often covered with little piles of soil, which look like toothpaste squeezed out of a tube. These are wormcasts, and they are soil that has passed through a worm's body. If you see lots of wormcasts, it's a sign of fertile soil.

Surface signs ►

Some worms make casts on the surface, but others leave them underground.



3 Fill the frame with layers of different coloured soils and sand to about 5 cm (2 in) from the top. Add a layer of leaves and a sprinkle of water to make the soil damp, but not wet. Put in the worms, then cover the wormery with a dark cloth and put it in a cool, dark place.

HOW EARTHWORMS FEED

Earthworms feed by swallowing soil and digesting any dead remains that it contains. The rest of the soil travels straight through them and is left behind as a cast. Some worms come to the surface at night and drag dead leaves underground. They nibble away parts of them and leave the rest to fertilize the soil.

Collecting trip ►

Earthworms collect leaves by holding them in their mouths and pulling them into their tunnels.



IMPORTANT

Don't let your wormery dry out, or the worms will die. When the wormery is full of tunnels, put the worms back where you found them.



4

Check your wormery every day and keep the soil damp. After a few days, you will see tunnels as the earthworms eat through the soil.

The soil will get mixed up by the tunnelling worms



Keeping bugs

Bugs can make fascinating pets, but before you buy them, ask where they came from. If they were raised in captivity, you will not be doing any harm. If they were not, buying them will encourage people to collect more from the wild.

Many bugs live in or near fresh water, so a pond is a good place to do some bug research

WHAT YOU CAN DO

- Find out if there is a natural history museum near you and visit it.
- Look on the Internet or in your local telephone directory to find contact details for any bug organizations in your area.
- Visit an insect zoo to see living insects from all over the world.
- Tell your friends about bugs and bughunting. They can help as well.

Helping bugs

Like all other animals, bugs live in a world that is changing fast. Many kinds are affected by pollution. Others are in trouble because their homes are being built on, ploughed up, or cut down. Some bugs are also harmed by collectors who gather them from the wild to sell as souvenirs. But the news isn't all bad because plenty of people are working hard to protect endangered bugs and help them survive. If you are keen on bugs, you can do your bit to help. Here are some good ways to start.



Join a bug club

One of the best ways to help bugs is to join a bug club. Many bug societies run clubs for younger members. You can find out about them on the Internet. Bug clubs organize bug-watching forays and they will also answer questions about any bugs that you find.

Visit an insect zoo

A great place to go to find out more about bugs is an insect zoo. Zoos breed their own bugs and they often raise some of the biggest and most exciting insects in the world. Many also have special houses for watching bugs that come out after dark.



BUG SOUVENIRS

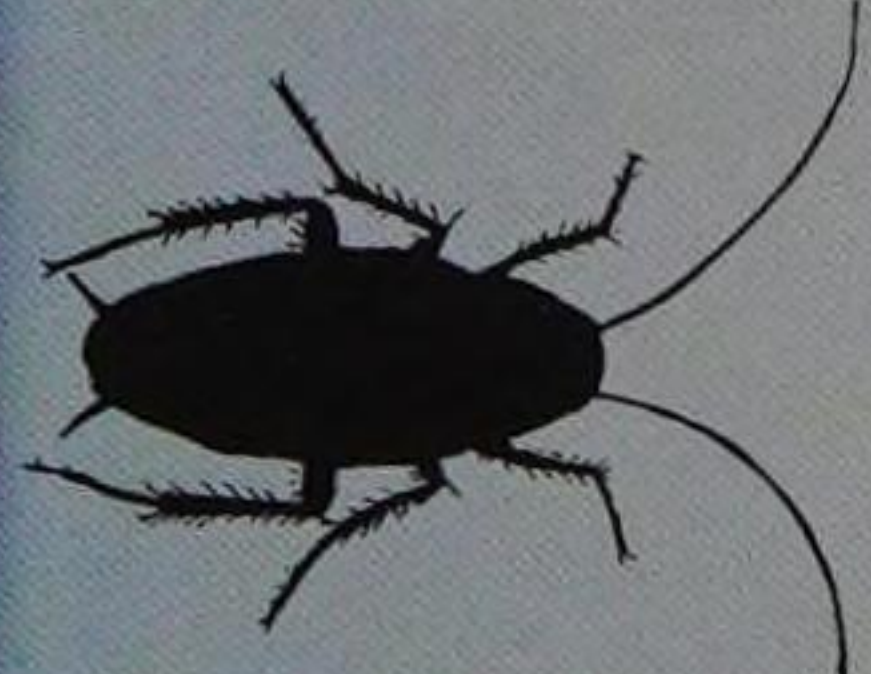
In some parts of the world, colourful butterflies are often sold as souvenirs. They look beautiful and they don't harm wild butterflies – as long as they have been bred on butterfly farms. But it's not always easy to tell where souvenir bugs have come from, or how they ended up in a shop. To be on the safe side, it's best to leave these souvenirs alone. If you want to see a butterfly collection, visit a local museum.

Studying butterflies ►

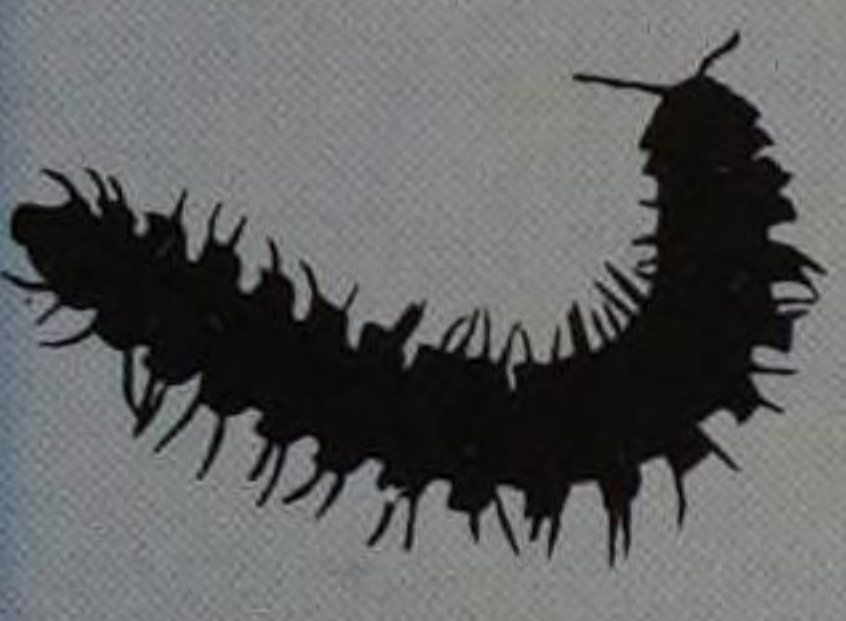
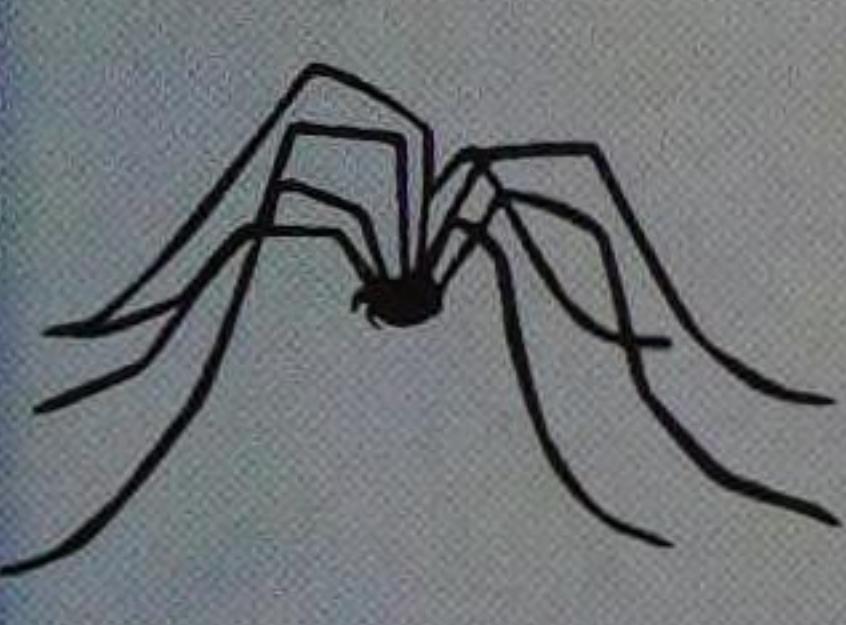
Many museums have butterfly collections. Scientists use them to study butterfly biology and to decide how different kinds should be classified. The scientists also study butterflies in the wild.



Bug classification There are at least a million species of insects in the world, together with lots of other kinds of bugs. Scientists classify them into different groups based on key features that they share.

INSECT	NAME OF GROUP	SPECIES TOTAL	KEY FEATURES	EXAMPLES
 Ground beetle	BEETLES Coleoptera	370,000	Beetles have hardened forewings that fit over their hindwings like a case. They live on land and in freshwater in most parts of the world, and eat all kinds of food.	Stag beetle Burying beetle Ladybird
 Dragonfly	DRAGONFLIES AND DAMSELFLIES Odonata	5,500	These large-eyed insects have long bodies and two pairs of filmy wings. As adults, they hunt other insects while on the wing.	Emperor dragonfly Green darner Azure damselfly
 Housefly	FLIES Diptera	122,000	Flies are the only flying insects with a single pair of wings. Most adult flies feed on liquids, but some eat pollen from flowers.	House fly Crane fly
 Cicada	BUGS Hemiptera	82,000	True bugs feed on plants or animals, using their sharp mouthparts to pierce their food. They have two pairs of wings.	Cicada Giant water bug Pond skater
 Cricket	CRICKETS AND GRASSHOPPERS Orthoptera	20,000	These stout-bodied insects have powerful hindlegs and are good at jumping. Most also have two pairs of wings, but some have tiny wings and cannot fly.	Speckled bushcricket Desert locust
 Cockroach	COCKROACHES Blattodea	4,000	Cockroaches are large, flat-bodied insects that sometimes feed indoors. They have powerful legs and can run away from danger.	American cockroach Madagascan hissing cockroach
 Butterfly	BUTTERFLIES AND MOTHS Lepidoptera	165,000	These insects are covered with tiny scales. The adults feed on nectar and other sugary liquids, and coil up their tongues when not in use.	Monarch butterfly Hawkmoth
 Wasp	BEEES, WASPS, AND ANTS Hymenoptera	108,000	All these insects have slender waists, and many of them also have a sting. Most have two pairs of wings joined by tiny hooks, but worker ants are wingless.	Honeybee Bumblebee Common wasp

On the left, you can find out about some of the most important groups of insects. For other bugs and creepy crawlies, look below. The species totals show the number that have been identified so far.

INSECT	NAME OF GROUP	SPECIES TOTAL	KEY FEATURES	EXAMPLES
 Centipede	CENTIPEDES Chilopoda	3,000	Centipedes are long, flat-bodied animals with lots of legs. They are fast-moving hunters, and attack their prey with their poisonous claws.	Giant centipede
 Millipede	MILLIPEDES Diplopoda	8,000	Millipedes resemble centipedes, but they have four legs on each segment of their bodies instead of two. They feed on plant remains.	Giant millipede
 Woodlouse	CRUSTACEANS Crustacea	40,000	Crustaceans have hard body cases and several pairs of legs. Most of them live in water, but some kinds live in damp places on land.	Woodlouse
 Spider	SPIDERS Araneae	40,000	Spiders are eight-legged predators with venomous fangs and several pairs of eyes. Many kinds make silk webs to catch their prey.	Garden orb-web spider Tarantula
 Harvestman	HARVESTMEN Opiliones	5,000	Harvestmen look similar to spiders, but have slender legs and oval bodies without a waist. Unlike spiders, they never make webs.	Harvestman
 Mite	TICKS AND MITES Acari	30,000	These eight-legged animals feed on a wide variety of food. Ticks suck blood, but mites attack both plants and animals.	Sheep tick House dust mite
 Scorpion	SCORPIONS Scorpiones	1,400	Scorpions are flat-bodied animals with four pairs of legs, two pincers, and a tail that has a venomous sting.	Imperial scorpion
 Pseudo-scorpion	PSEUDO-SCORPIONS Pseudoscorpiones	33,000	These tiny scorpion-like animals often live in leaf litter. Unlike true scorpions, they do not have a sting.	Pseudo-scorpion

Glossary

Abdomen The rear part of an insect's body. It contains the insect's digestive system and sometimes ends in a sting.

Ant A small insect that lives in a nest and gathers its food on plants or on the ground. Worker ants don't have wings, but they may have a sting.

Antennae Two jointed organs on the head of an insect, which it uses for sensing things.

Aphid A small sap-sucking bug that lives on plants. Aphids are also known as greenfly or blackfly, depending on their colour.

Bee A stinging insect that feeds at flowers. Some types of bee live in large nests, while others live on their own.

Beetle An insect that has thickened forewings, or elytra. When a beetle is on its feet, its elytra are closed up tightly.

Bug In everyday language, a bug is any kind of insect. To scientists, a "true bug" is a particular type of insect with piercing mouthparts and two pairs of wings. True bugs feed on plants and animals.

Butterfly An insect that has two pairs of wings covered in tiny scales and that usually flies by day. Most butterflies feed at flowers.

Camouflage Colours or patterns that help an animal to hide by making it blend in with its background.

Centipede A long-bodied animal with one pair of legs on each of its body segments. Centipedes have a poisonous bite.

Cephalothorax In spiders, the front part of the body. The cephalothorax is usually much bigger than the head, and the spider's legs are attached to it.

Crab spider A spider that catches insects by lurking in flowers. Unlike most spiders, crab spiders are often brightly coloured.

Crustacean An animal with a hard body, lots of pairs of legs, and two pairs of antennae. Apart from woodlice, most crustaceans live in the sea.

Damselfly An insect with a long, slender body and two pairs of transparent wings. Like dragonflies, damselflies grow up underwater.

Dragonfly A fast-flying insect with a long body and two pairs of stiff, transparent wings. Dragonflies grow up underwater.

Elytra Another word for a beetle's forewings. Elytra are much thicker than the beetle's hindwings, which they protect when the beetle is crawling about.

Entomologist Someone who studies insects.

Fangs In spiders, a pair of sharp mouthparts that stab into the spider's prey, injecting venom.

Feelers An everyday word for an insect's antennae.

Fly An insect that has only one pair of wings.

Forewings An insect's front wings. The forewings are often bigger than the hindwings, and in some insects they are thick or leathery.

Gall A plant growth used as a home by insects. The insects give off chemicals that make the galls grow.

Gall wasp Tiny wasps that grow up inside plant galls.

Grasshopper An insect with strong back legs and leathery forewings. Grasshoppers are very good at jumping and they feed on plants.

Grub A young insect or larva. Grubs look very different from adult insects and they often live inside their food.

Habitat The kind of surroundings that an animal normally lives in. Insect habitats include forests, deserts, and freshwater.

Hibernation A long winter sleep. Many insects hibernate, because they cannot move or find food when the weather gets cold.

Hindwings An insect's back wings.

Honeycomb A hanging sheet of wax full of small spaces, or cells. Honeybees make honeycombs to store honey and to raise their grubs.

Honeydew The sugary liquid that aphids produce when they feed.

Hoverfly A fast-flying insect that feeds on nectar. Hoverflies get their name because they often hover over flowers.

Jumping spider A spider that has large eyes and that catches its prey by jumping on to it instead of by making a web.

Lacewing A night-flying insect that has a slender body and two pairs of wings with lacy veins.

Larva (plural larvae) A young insect that looks very different from its parents and that changes shape as it grows up. Grubs, caterpillars, and maggots are all examples of larvae.

Leaf miner An insect grub that feeds by chewing or "mining" its way through the inside of a leaf.

Life cycle All the stages in an animal's life, from the moment it starts life to the moment when it has young.

Metamorphosis The change in shape that happens as an insect or other animal grows up.

Millipede A long-bodied animal with two pairs of legs on each of its body segments. Millipedes have hard bodies and often coil up into a spiral if they are touched.

Mimic A harmless animal that protects itself by looking like a dangerous one. Many insects use mimicry to survive.

Moth An insect that has two pairs of wings covered in tiny scales and that usually flies by night. Most moths feed at flowers.

Nectar The sugary liquid that flowers make to attract insects.

Orb web A web with a circular shape.

Parasite An animal that feeds on the living body of another one.

Pedipalps (palps) Two small "arms" on either side of a spider's head. Spiders use their palps for signalling, mating, and for testing food.

Pollen The dust-like substance that plants produce.

Predator An animal that hunts others for food.

Prey An animal that is hunted by a predator.

Pupa The resting stage in the life cycle of many insects, when the young insect's body is broken down and an adult one is built in its place.

Queen bee In a bees' nest, the queen is the only bee that lays eggs. She controls the nest and is looked after by the worker bees. Wasps, ants, and termites also have queens.

Saddle In adult earthworms, a smooth band around the body, about one-third of the way down.

Scavenger Any animal that feeds on dead remains.

Solitary bee A bee that lives alone instead of living with other bees in a nest.

Termite A wood-eating insect that lives in a nest. Unlike ants, termites usually feed at night and they do not have stings.

Thorax The middle part of an insect's body. The other two parts are the head and the abdomen.

Wasp A stinging insect with two pairs of wings. Wasps are often coloured yellow and black to show other animals that they are dangerous, so they leave them alone.

Worker An insect that lives in a nest and that carries out the daily tasks needed to keep the nest thriving. Unlike the queen, workers do not breed.

Index

ant lions 13
ants 30, 32–33, 34, 37, 68
aphids 9, 34–5

bark beetles 38, 39
bees 8, 9, 24, 26–29, 30, 68
beetles 4–5, 7, 9, 13, 16, 68
bluebottles 9, 43
bolas spiders 53
bombardier beetles 13
bug clubs 66
butterflies 8, 9, 18–19, 21, 24, 25, 42–43, 67, 68
butterfly bars 18–19
butterfly nets 14–15

camouflage 9, 10–11
carpenter bees 29
catching bugs 14–17, 22–23
caterpillars 9, 10, 20–21, 38
centipedes 5, 9, 59, 69
choice chambers 60–61
click beetles 12, 13
clothes moths 23
crab spiders 47, 54
crustaceans 5, 69

damselflies 45, 68
dances, honeybees 26–27
digger wasps 60
draglines, spiders' 52–53
dragonflies 7, 8, 9, 45, 68

earthworms 62–65
earwigs 59
eggs 21, 56
entomologists 4
equipment 6
eyes 41, 46

flies 15, 37, 40–41, 46, 68
flowers 24–27, 54
flying insects 14–15

freshwater insects 8, 44–45
fruit flies 40–41

galls 36–37
glow-worms 17
grass spiders 47
grasshoppers 21, 68
greenflies 34–35
ground beetles 16
grubs 36–37

habitats 8–9
hibernation 43
hives 27, 28
honeybees 26–27, 28
honeycomb 27
honeydew 34, 35
horse flies 41
house flies 9, 41
hoverflies 9, 11, 24, 25

identifying bugs 7

jumping spiders 47, 55

lacewings 15, 35
ladybirds 5, 15, 35, 43
larvae 38–39, 43, 45
leaf litter 8, 58–59
leaf miners 38–39
leafcutter bees 28

magnifying glasses 6, 7, 11
mason bees 28–29
millipedes 5, 9, 59, 69
mimicry 11
morpho butterflies 42–43
mosquitoes 9, 41, 45
moth traps 22–23
moths 18, 21, 22–23, 38–39, 68

nectar 9, 24–25
nests 30–31

orb-web spiders 47, 48, 49

pitfall traps 16–17
poisons 13, 46
pond skaters 44–45
pseudoscorpions 58, 69
pupa 21

queens 27, 30–31

rove beetles 59

safety 6
silk 48, 52, 56
solitary bees 28–29
spiders 5, 9, 21, 46–57, 69
spittlebugs 12
springtails 59
sunbathing 42–43

tarantulas 47, 54, 55
termites 31
tongues, butterflies 19, 25
trapdoor spiders 51
traps 16–17, 22–23
tricks 12–13

wasps 11, 30–31, 35, 37, 60, 68
water boatmen 45
webs 46, 48–51
wings 15, 42–43
wolf spiders 55, 56–57
wood ants 30
woodlice 8, 9, 59, 60–61
wormeries 64–65

zoos 67

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Gold beetle



Cat flea



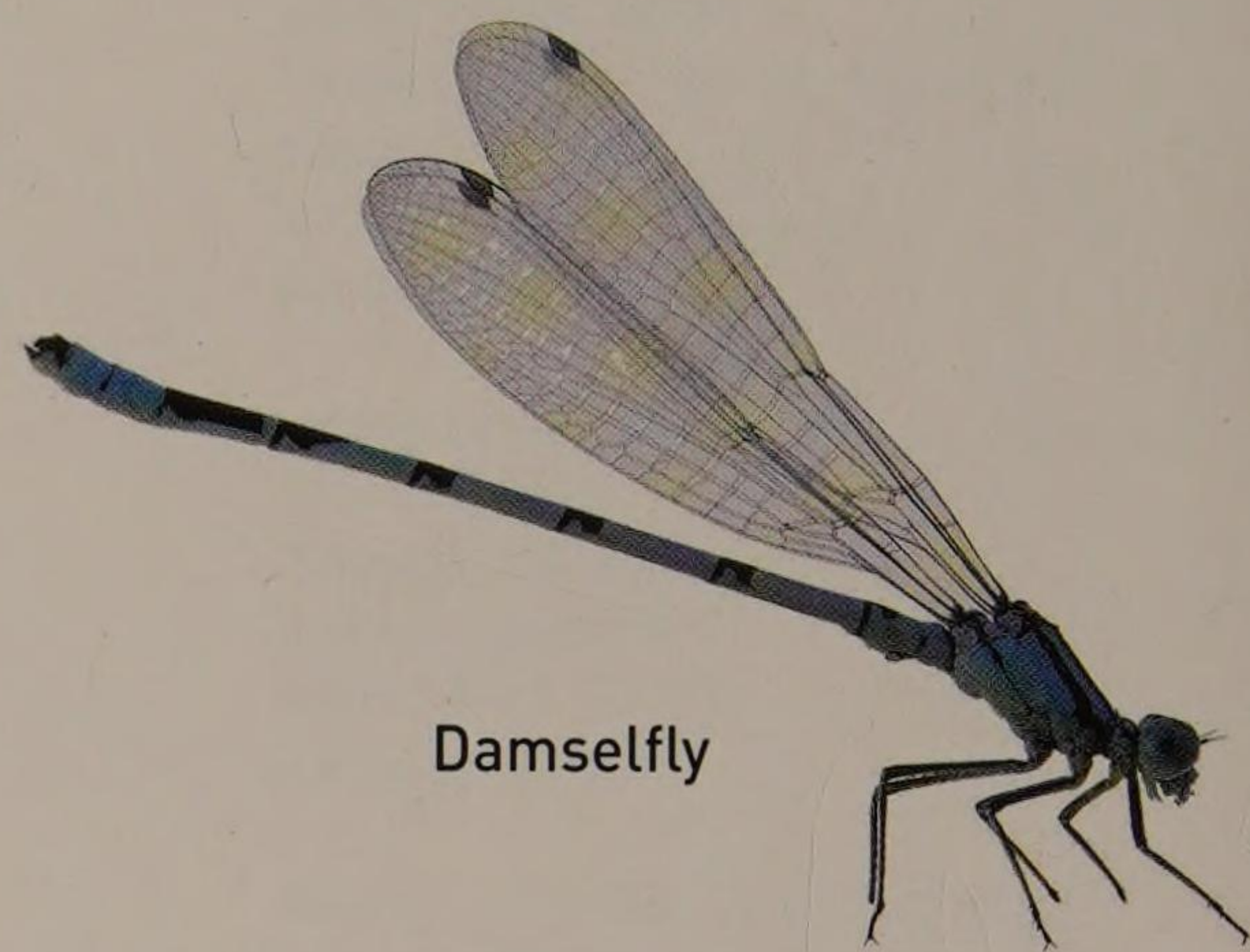
American moon moth



Honeybee



Spiny-bellied
orb weaver



Damselfly



Cave spider



Queen Alexandra's birdwing



Puss moth
caterpillar



Wood ant



Desert locust



American cockroach



Drone honeybee



Ant lion



Rhinoceros beetle



Giant water bug



Black scorpion



Caterpillar



Praying mantis



Cockchafer beetle



Shield bug



Bluebottle fly



Conehead mantis



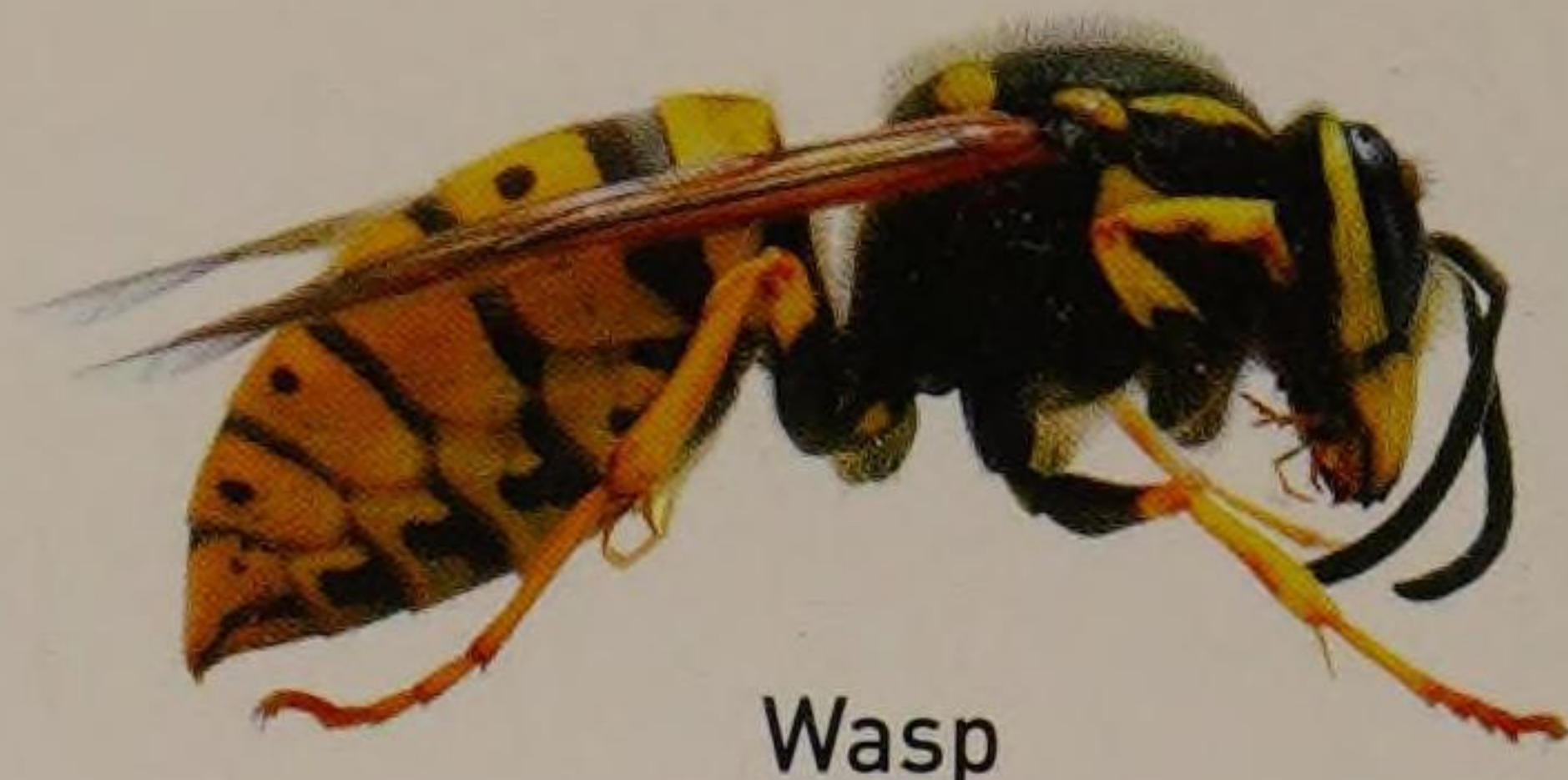
Black swallowtail caterpillar



Book louse



Garden tiger moth



Wasp



Dung beetle



Mosquito



Mexican red-kneed tarantula



Owl butterfly



Millipede



Prince baskettail dragonfly



Grasshopper



Trapdoor spider



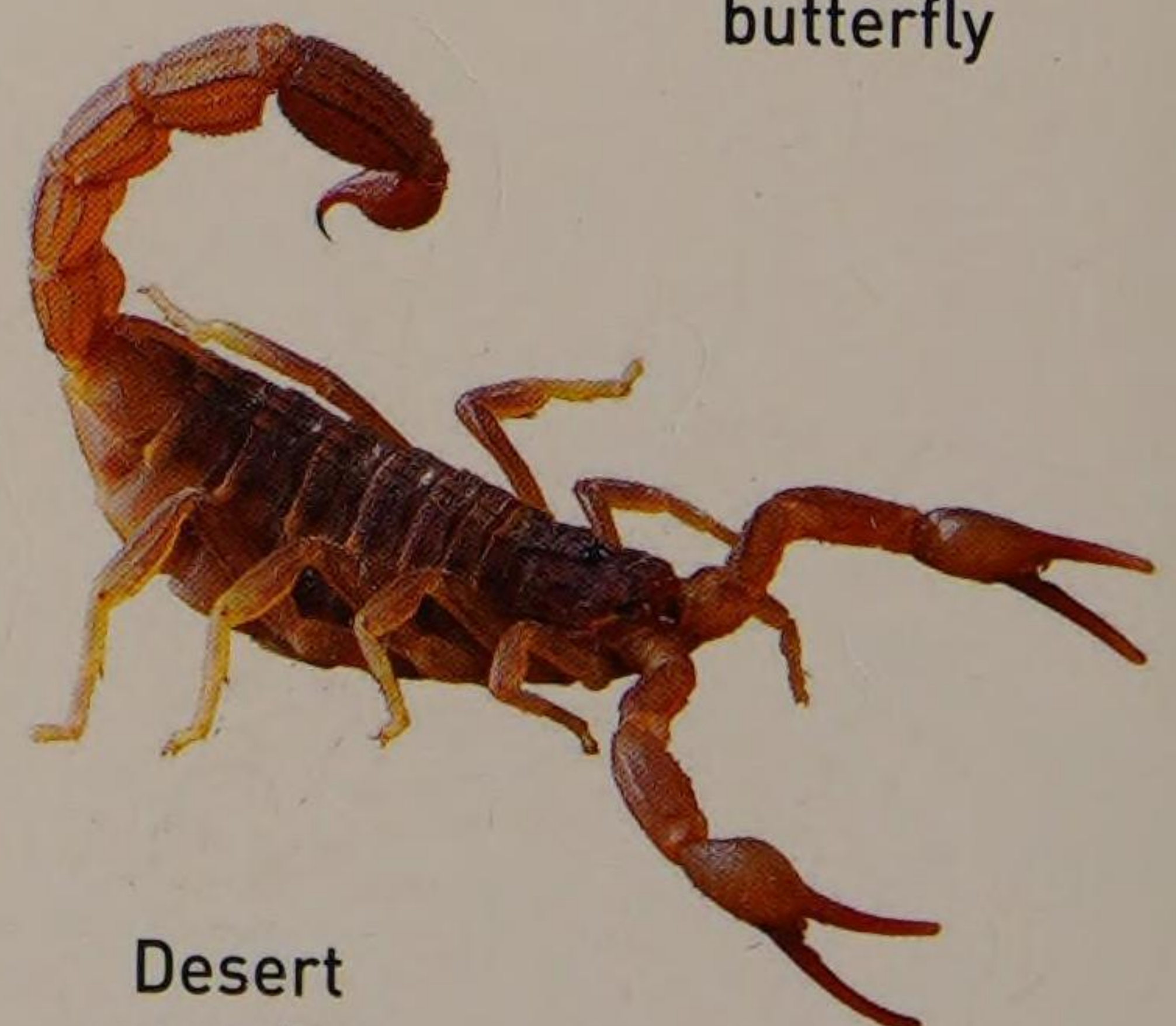
Longwing butterfly



Praying mantis



Ladybird



Desert scorpion



Giant tiger centipede



Madagascan sunset moth



Silk moth

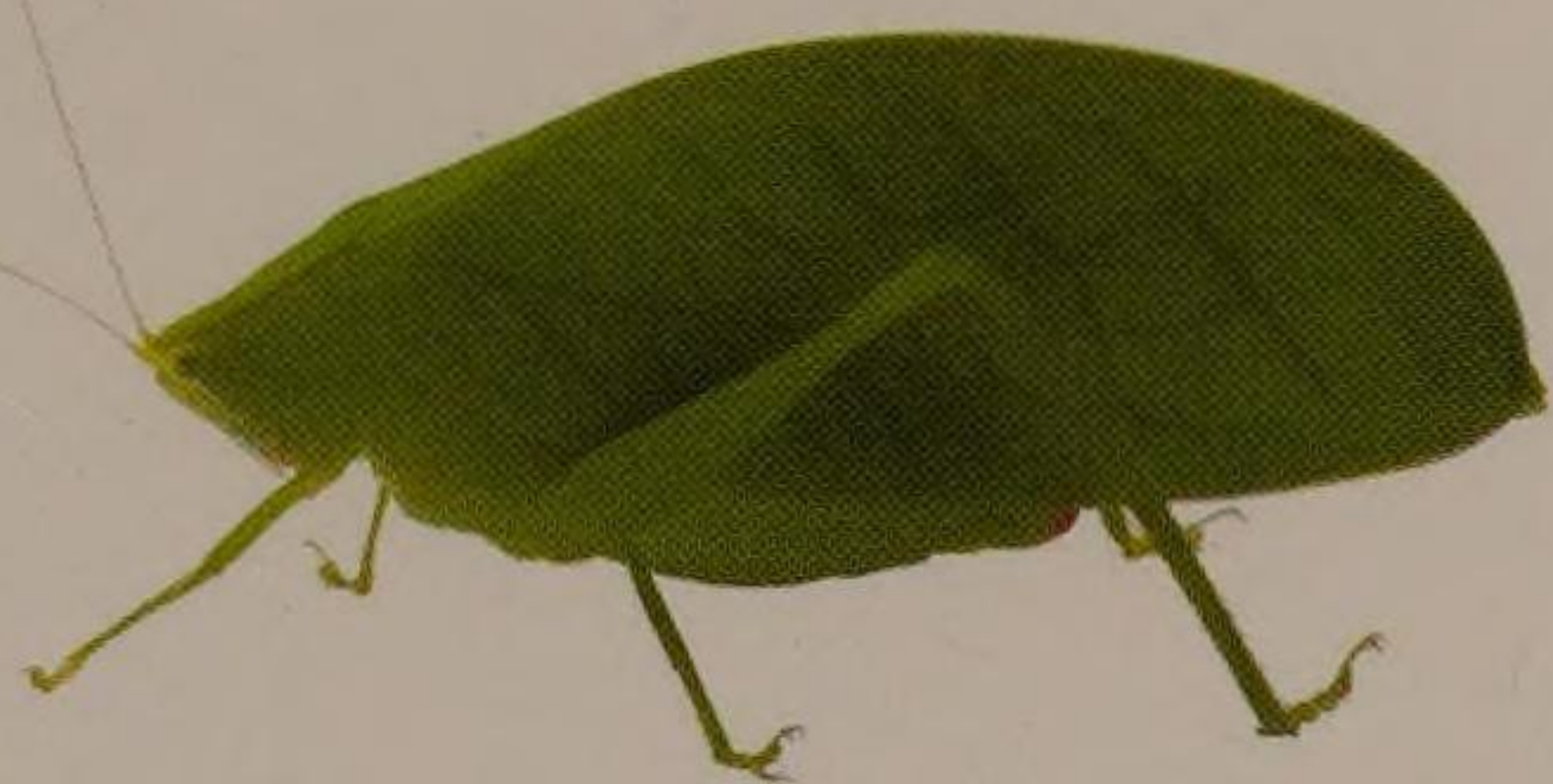


Great diving beetle



Shield bug

Leaf-shaped grasshopper



Orange baboon spider



Wart-headed bug



Orchid mantis



Jewel weevil



Broad-bodied chaser



Thorn bug



Madagascan hissing cockroach

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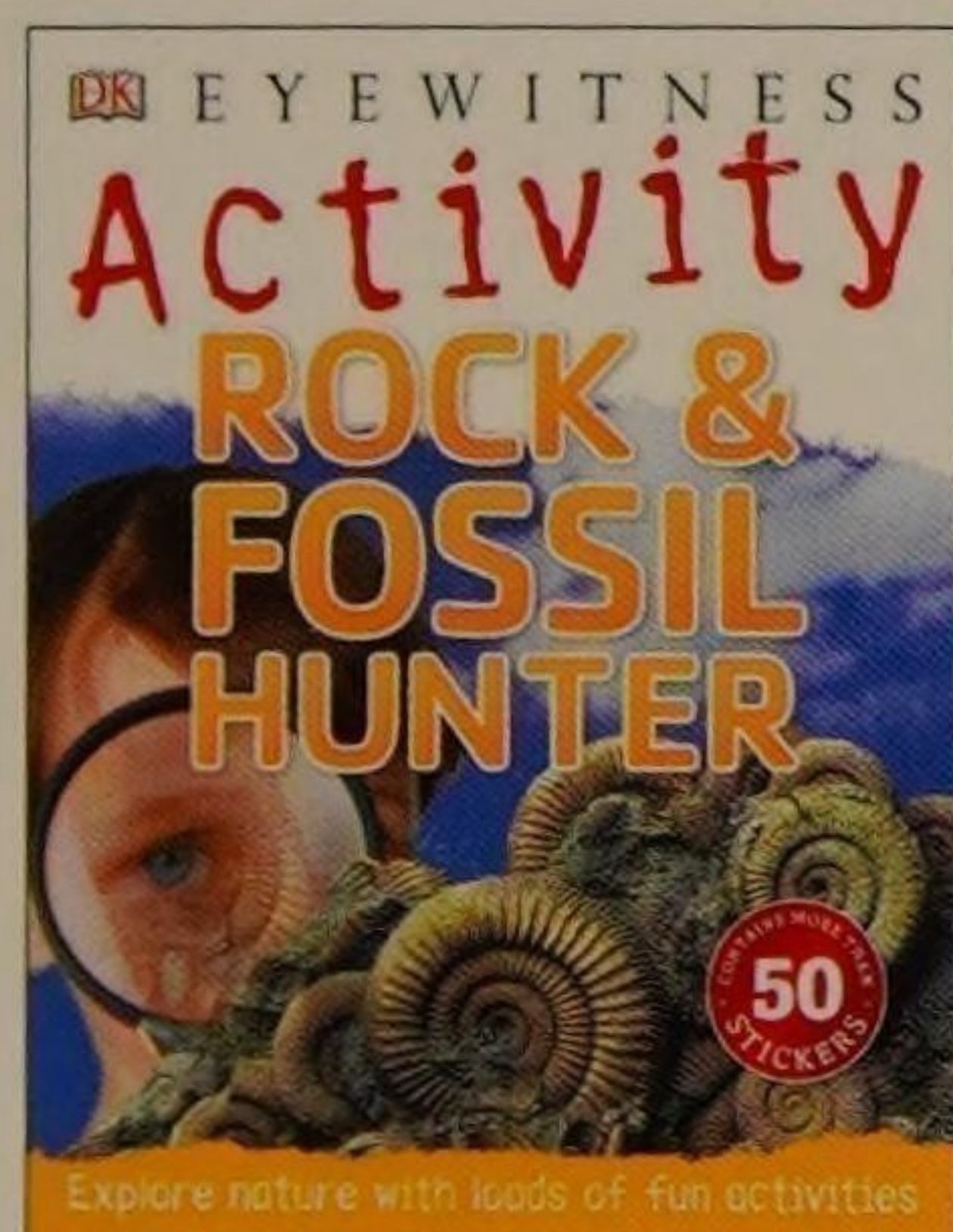
Train honeybees to find food.



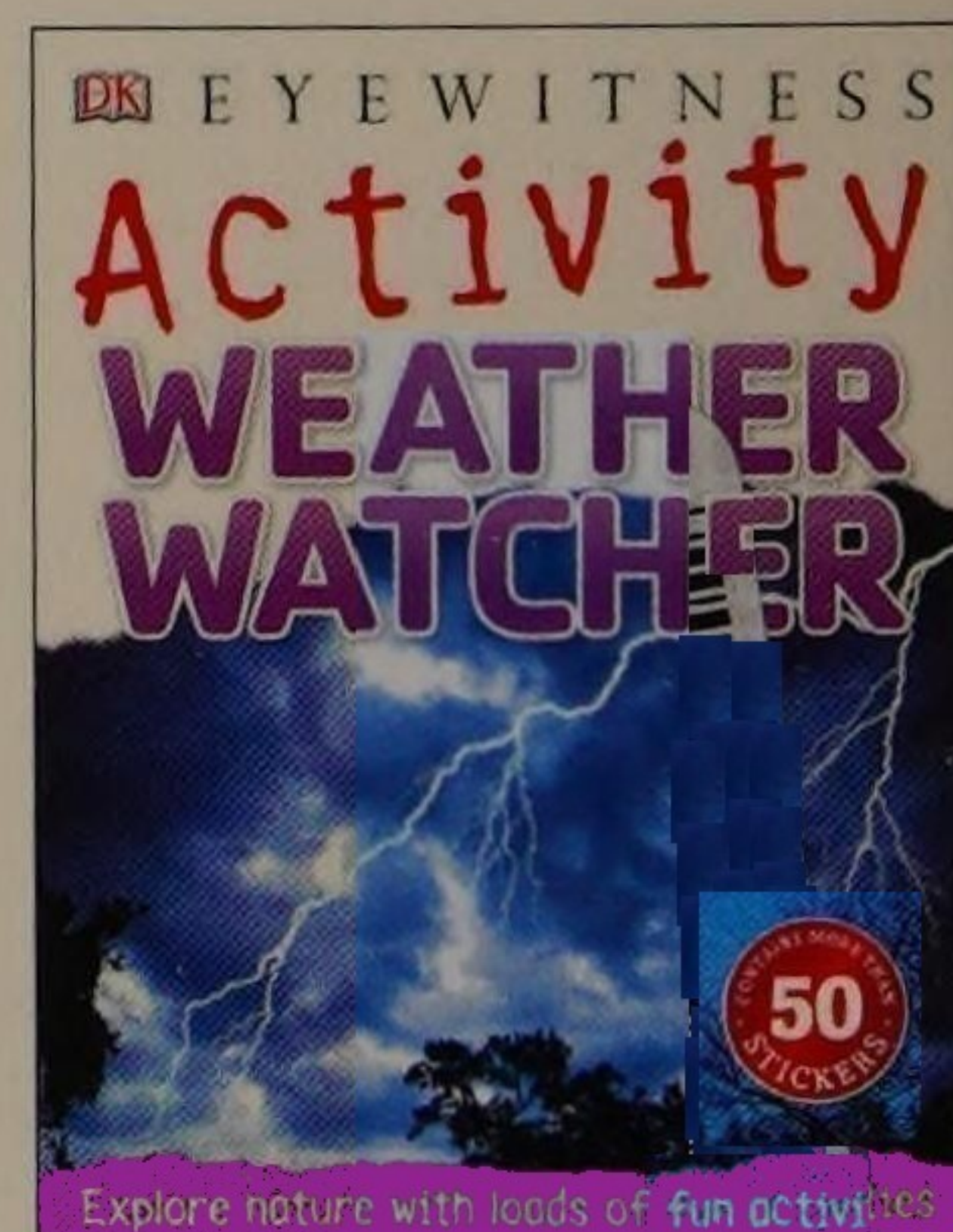
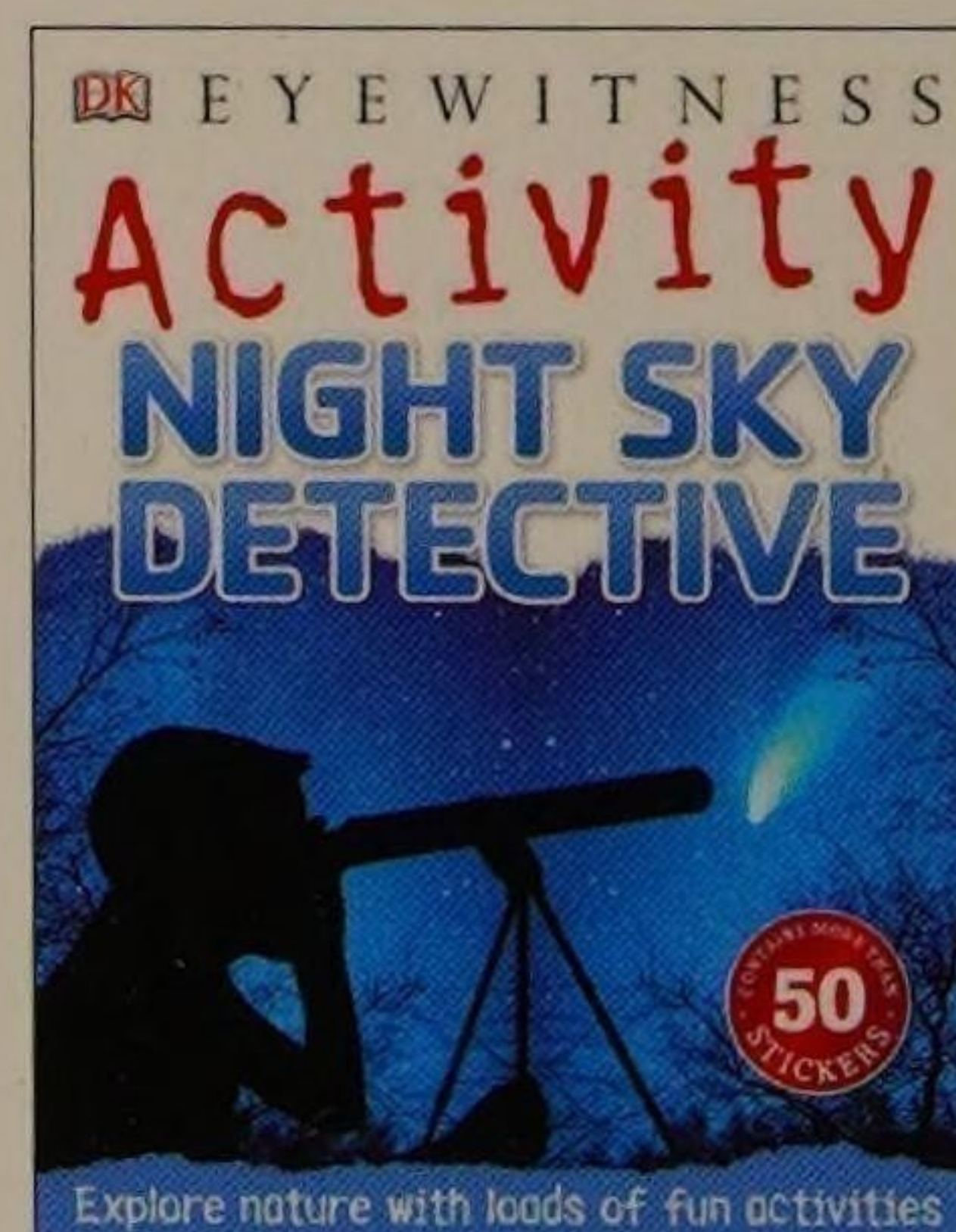
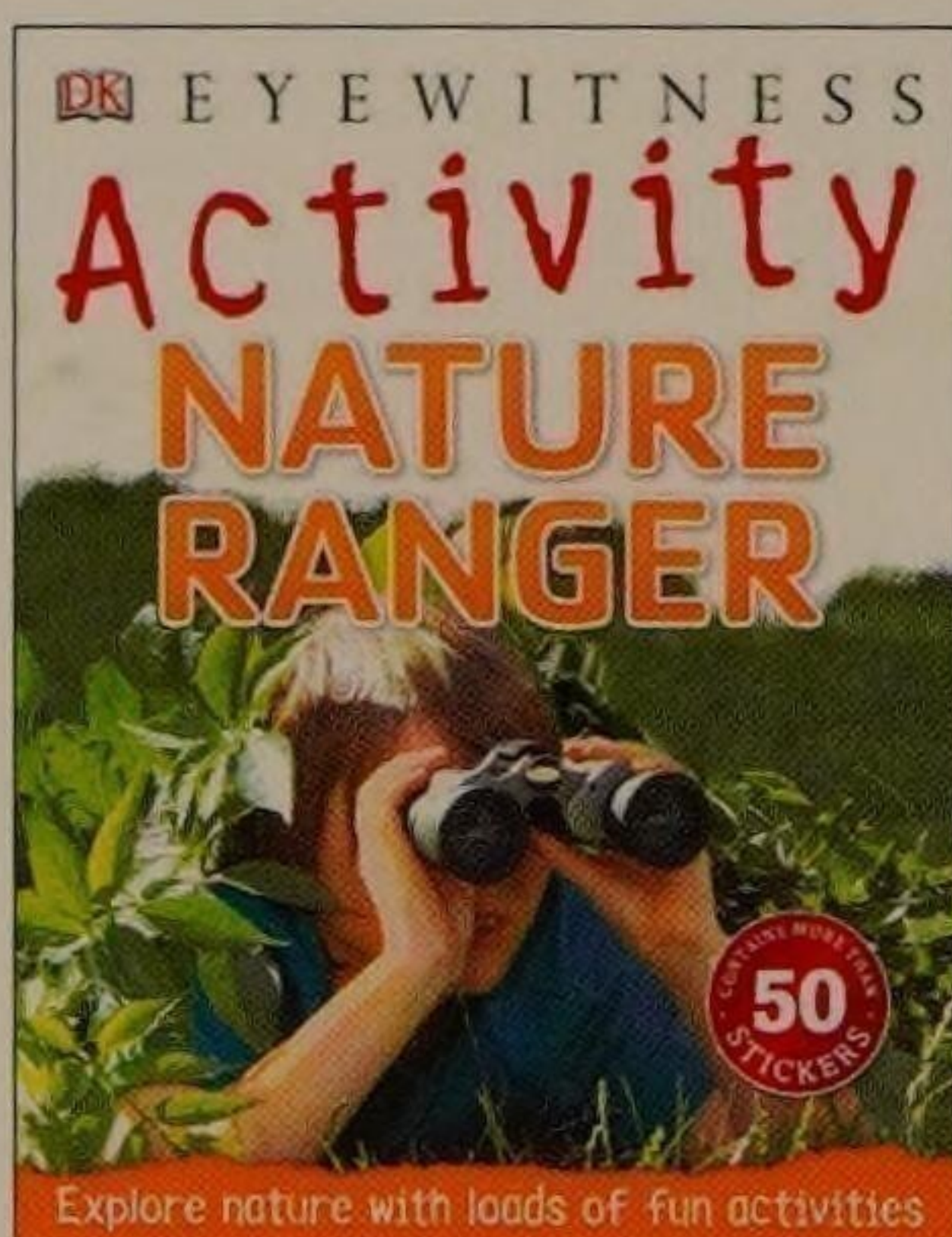
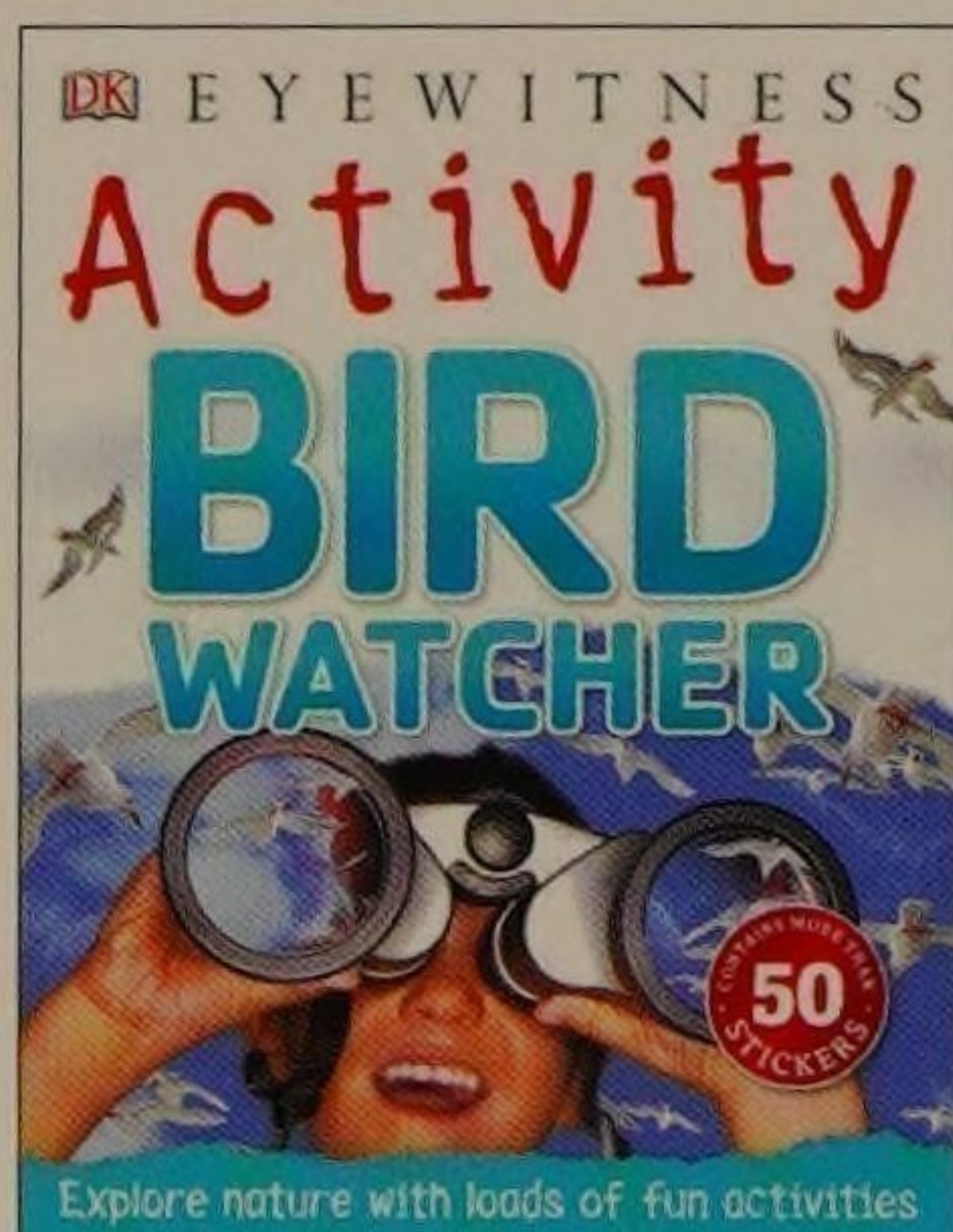
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